ROLE OF STAGING LAPAROSCOPY IN CARCINOMA STOMACH"

A Dissertation Submitted to

The Tamil Nadu Dr. M.G.R. Medical University,

In partial fulfillment of the regulations for the award of the Degree of

MASTER OF SURGERY (GENERAL SURGERY)

Branch I: M.S. (Gen Surg)

Department of General Surgery,

GOVERNMENT STANLEY MEDICAL COLLEGE & HOSPITAL,

Chennai – 600 001.

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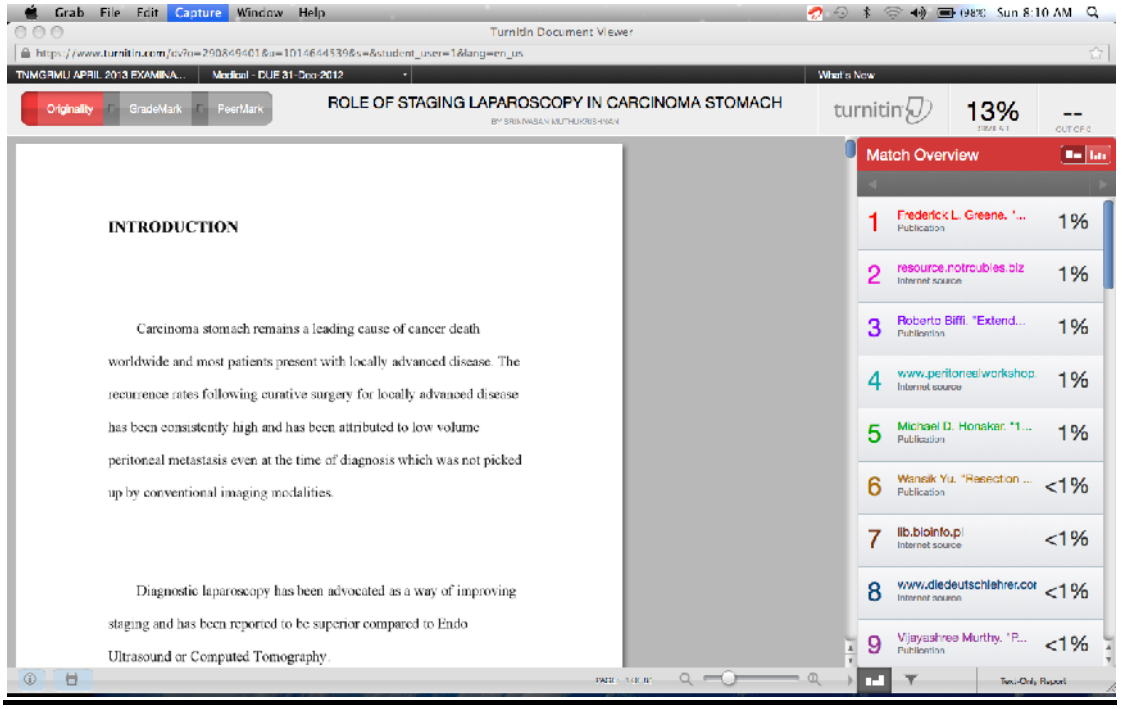
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INTRODUCTION
Carcinoma stomach remains a leading cause of cancer death worldwide and most patients present with locally advanced disease. The recurrence rates following curative surgery for locally advanced disease has been consistently high and has been attributed to low volume peritoneal metastasis even at the time of diagnosis which was not picked up by conventional imaging modalities.
Diagnostic laparoscopy has been advocated as a way of improving staging and has been reported to be superior compared to Endo Ultrasound or Computed Tomography.
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Title of the Work : Role of Staging Laparoscopy in Carcinoma Stomach

Principal Investigator : Dr.M.Srinivasan

Designation : PG in M.S (General Surgery)

Department : Department of General Surgery
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The request for an approval from the Institutional Ethical Committee (IEC) was considered on the IEC meeting held on 12.10.2011 at the Modernized Seminar Hall, Stanley Medical College, Chennai-1 at 2PM

The members of the Committee, the secretary and the Chairman are pleased to approve the proposed work mentioned above, submitted by the principal investigator.

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CERTIFICATE

This is to certify that Dr. M. SRINIVASAN, postgraduate student (May 2010 – April 2013) in the department of General Surgery, Stanley medical college, Chennai, has completed his dissertation titled ***"ROLE OF STAGING LAPAROSCOPY IN CARCINOMA STOMACH"*** under the direct guidance and supervision in partial fulfillment of the regulations laid down by the TamilnaduDr.M.G.R. Medical University, Chennai for M.S., Branch – I General surgery degree examination

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DECLARATION

I, Dr. M. SRINIVASAN, solemnly declare that the dissertation titled **"ROLE OF STAGING LAPAROSCOPY IN CARCINOMA STOMACH"** is a bonafide work done by me at Govt. Stanley Medical College and Hospital under the guidance and supervision of my unit chief,

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Professor of General Surgery

This dissertation is submitted to the Tamilnadu Dr. M.G.R. MEDICAL UNIVERSITY towards the partial fulfillment of the requirements for M.S., Branch I General Surgery degree examination.

Place: Chennai – 600001
Date: Dr. M. SRINIVASAN

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CONTENTS

INTRODUCTION

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Carcinoma stomach remains a leading cause of cancer death worldwide and most patients present with locally advanced disease. The recurrence rates following curative surgery for locally advanced disease has been consistently high and has been attributed to low volume peritoneal metastasis even at the time of diagnosis which was not picked up by conventional imaging modalities.

Diagnostic laparoscopy has been advocated as a way of improving staging and has been reported to be superior compared to Endo Ultrasound or Computed Tomography.

The benefits of staging laparoscopy are:

a) Its ability to detect distant metastases especially small volume peritoneal metastasis by direct visualization under magnification which are usually missed by conventional imaging, thereby protecting the patient from an unnecessary laparotomy.

b) Laparoscopy allows pathologic confirmation of nodal status, which could aid prognostication and help define radiation fields.

c) Providing tissue samples to assess the prognostic ability of molecular markers.

d) Staging laparoscopy, unlike EUS, is not prevented or limited by esophageal obstruction.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Epidemiology of gastric cancer

Gastric cancer affects more than 8,00,000 new individuals world-wide each year. Over the past few decades, there has been a drastic decline in the rates of stomach cancer in many developed countries. Interestingly, this decline is only limited to the incidence of distal gastric cancers. However, the occurrence of proximal gastric and gastro-oesophageal junction cancers is actually rising.

In India, the incidence of gastric cancer is showing a more gradual decline in all the population based tumour registries. Data from the country's northeastern registries however continues to show some very high incidences.

Mortality rates from gastric cancer approach incidence rates and most patients present with advanced disease.

Surgical Anatomy

Histology

The stomach has a fundus, a body and a pylorus which have specific histologic features.

- The cardia mainly has goblet cells, which secrete mucin.
- The body contains mucin cells, chief or zymogenic cells, and parietal or oxyntic cells.
- The pylorus contains G cells which secrete gastrin.

Histologically, the stomach wall has 5 layers - the mucosa, the submucosa, the muscularis layer, subserosa and the serosa.

Relations

- The stomach is related superiorly by the diaphragm and left lobe of liver;
- Anteriorly by the abdominal wall and
- Below by the transverse colon, mesocolon, and greater omentum.
- Posteriorly and to the left are the spleen, pancreas, left adrenal gland, left kidney, and splenic flexure of the colon.

Cancers arising from the proximal stomach may directly involve the splenic hilum/ spleen, diaphragm, left lateral segment of the liver and tail

of pancreas, whereas more distal tumors may invade the transverse colon or the pancreatic head.

According to the Japanese classification system, gastric cancer is classified into those involving the antrum or lower part (L) – 40%, the body or middle part (M) – 40% and the upper part (U) – 15%. Involvement of more than one part of the organ (designated as LM or UM or LMU etc) occurs in 10% of patients.

Blood supply

The blood supply to the stomach is extensive and is based on vessels arising from the celiac axis (Fig. 1). The right gastric artery from the hepatic artery, and the left gastric artery, a direct branch of the celiac axis, course along the lesser curvature. Along the greater curvature are the right gastroepiploic artery, which originates from the gastroduodenal artery at the inferior border of the proximal duodenum, and the left gastroepiploic artery, branching from the splenic artery laterally. The short gastric arteries (vasa brevia) arise directly from the splenic artery and make a relatively small contribution to the blood supply to the proximal portion of the stomach.

The preservation of any of these vessels in the course of a subtotal gastrectomy for carcinoma is not necessary and the most proximal few centimeters of remaining stomach are well supplied by collateral flow from the lower segmental esophageal arcade and the inferior phrenic vessels. The rich submucosal blood supply of the stomach is an important factor in its ability to heal rapidly and produce a low-incidence of anastomotic disruption.

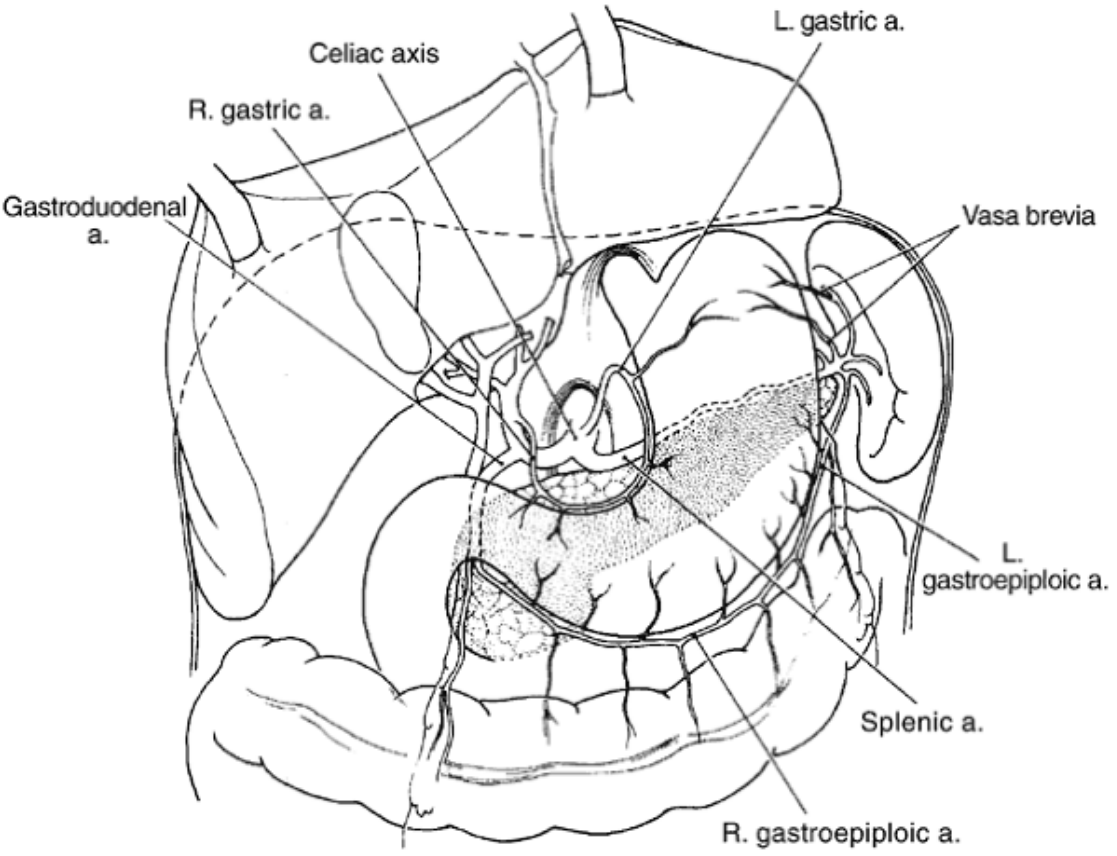


Fig 1: Arterial supply of stomach

The venous supply of the stomach tends to parallel the arterial supply. The venous efflux ultimately passes the portal venous system and is reflected in the fact that the liver is a primary site for distant metastatic spread.

Lymphatic drainage

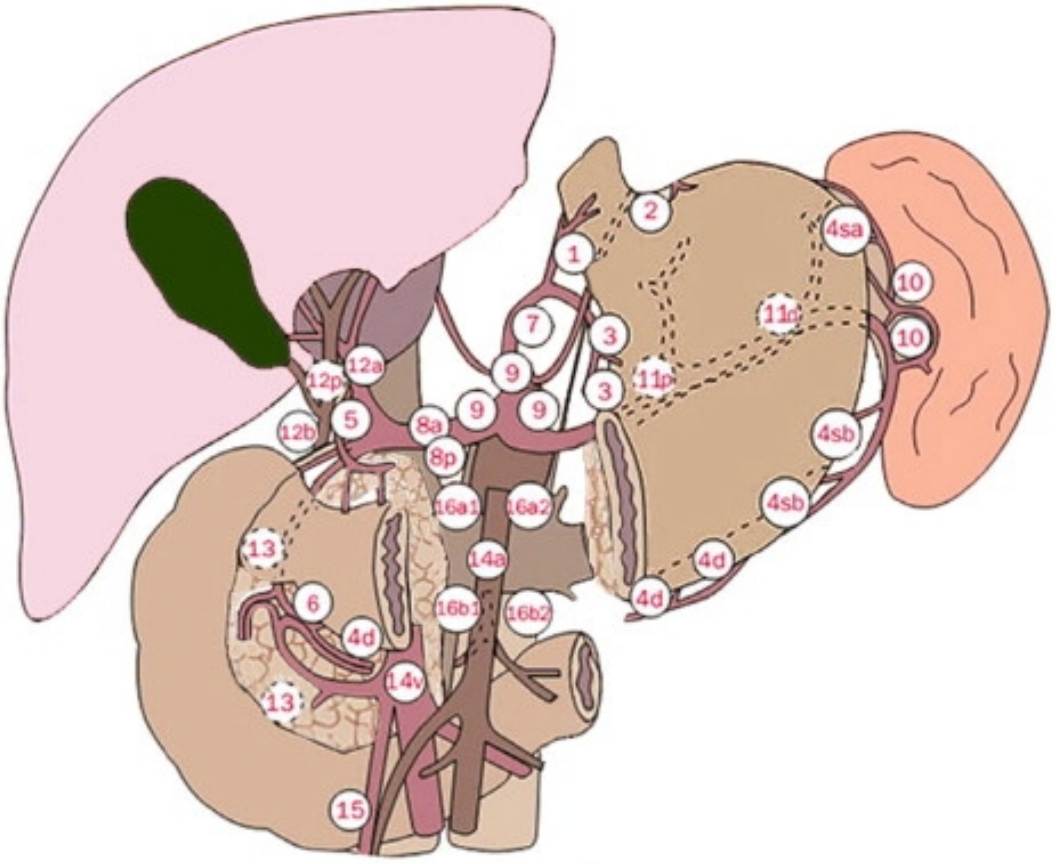
The lymphatic drainage of the stomach is extensive, and distinct anatomic groups of first echelon perigastric lymph nodes have been defined according to their relationship to the stomach and its blood supply: right and left cardiac, lesser and greater curvature and the supra and subpyloric nodes. and gastroepiploic nodes, and along the lesser curvature are the suprapyloric and the lesser curvature lymph nodes.

The second echelon (extraperigastric) nodes include the common hepatic, left gastric, splenic hilum and splenic artery lymphatics, which drain into the celiac and periaortic lymphatics. Proximally are the lower esophageal lymph nodes;

Extensive spread of gastric cancer along the intrathoracic lymphatics may be manifested clinically by a metastatic lymph node in the left supraclavicular fossa (Virchow's node) or left axilla (Irish's node). As the submucosal lymphatic supply of the stomach becomes extensively

involved with tumor, other routes of lymphatic drainage may be recruited. Tumor spread can occur along the falciform ligament to the lymphatics in the hepatoduodenal ligament resulting in subcutaneous periumbilical tumor deposits known as Sister Mary Joseph's nodes.

The regional lymph nodes are grouped into stations numbered as in Fig.2 as per the Japanese system. They classified into three groups based upon the location of the primary tumor.



No. 1 Right paracardial LN
No. 2 Left paracardial LN
No. 3 LN along the lesser curvature
No. 4sa LN along the short gastric vessels
No. 4sb LN along the left gastroepiploic vessels
No. 4d LN along the right gastroepiploic vessels
No. 5 Suprapyloric LN
No. 6 Infrapyloric LN
No. 7 LN along the left gastric artery
No. 8a LN along the common hepatic artery (Anterosuperior group)
No. 8p LN along the common hepatic artery (Posterior group)
No. 9 LN around the celiac artery
No. 10 LN at the splenic hilum
No. 11p LN along the proximal splenic artery
No. 11d LN along the distal splenic artery
No. 12a LN in the hepatoduodenal ligament (along the hepatic artery)
No. 12b LN in the hepatoduodenal ligament (along the bile duct)
No. 12p LN in the hepatoduodenal ligament (behind the portal vein)

No. 13 LN on the posterior surface of the pancreatic head
No. 14v LN along the superior mesenteric vein
No. 14a LN along the superior mesenteric artery
No. 15 LN along the middle colic vessels
No. 16a1 LN in the aortic hiatus
No. 16a2 LN around the abdominal aorta (from the upper margin of the celiac trunk to the lower margin of the left renal vein)
No. 16b1 LN around the abdominal aorta (from the lower margin of the left renal vein to the upper margin of the inferior mesenteric artery)
No. 16b2 LN around the abdominal aorta (from the upper margin of the inferior mesenteric artery to the aortic bifurcation)

Fig 2: Lymph node stations of stomach

Pathology and Tumor Biology

Adenocarcinoma constitutes approximately 95% of all malignant neoplasms of stomach. Other malignancies, which can rarely occur, are squamous cell carcinomas, leiomyosarcoma, adenoacanthoma, carcinoid tumors and lymphomas. The differentiation between adenocarcinoma and lymphoma can sometimes be difficult but is essential because staging, treatment, and prognosis are different for each disease.

Morphological classification

Early Gastric cancer is classified by Japanese system into three groups (Fig 3).

Advanced gastric cancer is morphologically classified using the Borrmann classification (Fig.4) depending on the macroscopic appearance.

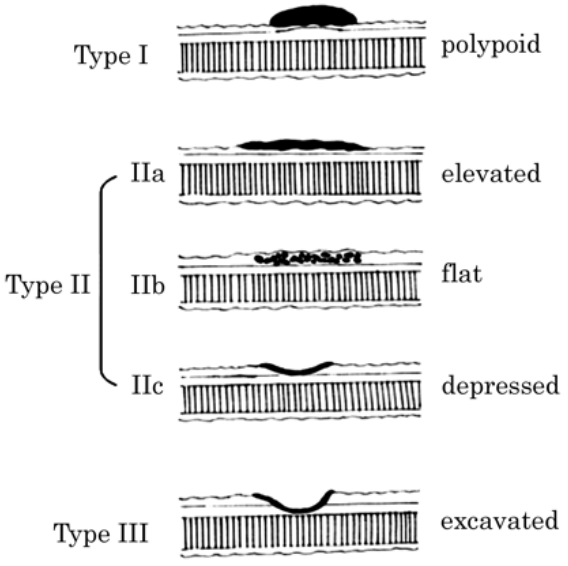


Fig 3: Japanese classification of Early Gastric cancer

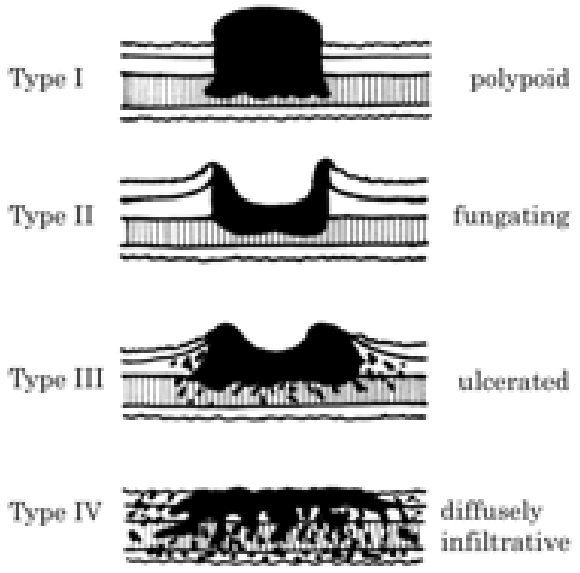


Fig 4: Borrmann's classification

The macroscopic type of the primary neoplasm should be reported along with the T stage.

Ming has proposed a histomorphologic staging system that divides gastric cancer into either a prognostically favorable expansive type or a poor prognosis infiltrating type. Based on an analysis of 171 gastric cancers, the expansive-type tumors were uniformly polypoid or superficial on gross appearance, whereas the infiltrative tumors were almost always diffuse. Grossly ulcerated lesions were equally divided between the expanding or infiltrative forms.

The commonly used Lauren's DIO system classifies gastric cancers into intestinal type (53%), diffuse type (33%), and unclassified (14%).

The intestinal type is associated with chronic atrophic gastritis, severe intestinal metaplasia, and dysplasia and tends to be less aggressive than the diffuse type. The diffuse type of gastric cancer is more likely to be poorly differentiated and is associated with younger patients and proximal tumors.

Broder's classification of gastric cancer grades tumors histologically from 1 (well- differentiated) to 4 (anaplastic). This correlates with the Bormann’s classification with ninety percent of protruding or superficial cancers being well differentiated (Broder's grade 1) and almost half of all ulcerated tumors being poorly differentiated or diffusely infiltrating (Broder's grades 3 and 4).

Oesophagogastric junction cancers are classified using the Siewert's classification, into three distinct types:

Type 1: Adenocarcinoma of the distal esophagus, between 1 to 5 cm from the anatomic cardia. it commonly arises from Barrett's esophagus and can involve the esophagogastric junction from above.

Type II: Adenocarcinoma of the cardia, occurring in the region between 1 cm proximal and 2 cm distal to the anatomic cardia.

Type III: Adenocarcinoma of the proximal stomach, 2- 5 cm from the anatomic cardia.

The classification is based on morphology and the anatomic location of the epicenter of the tumor as discerned by barium swallow, upper GI scopy, CT, and intraoperative findings.

The Siewert's classification has important therapeutic implications. Lymphangiographic studies have shown that the lymphatic pathways from the lower oesophagus (type 1) pass both cephalad (into the mediastinum) and caudad (toward the celiac axis). In contrast, the lymphatic drainage from the cardia and subcardiac regions (types II and III) is toward the celiac axis, splenic hilum, and para-aortic nodes. Type I tumors require an oesophagectomy, whereas types II and III tumors can be treated by transabdominal extended gastrectomy (resection of the stomach and distal intra-abdominal esophagus).

Patterns of Spread

The spread of stomach cancer can occur by several modes including local infiltration into the adjacent structures, lymphatic and peritoneal metastases, and by distant hematogenous spread. The cancer initially grows by penetration into the gastric wall and infiltrating intramurally -

often through intramural lymphatics or in the subserosal layers, thus progressively involving an increasing thickness and percentage of the stomach respectively.

Tumor penetration through the gastric serosa, with consequent risk of tumor invasion into adjacent structures or peritoneal spread and involvement of lymphatics have therapeutic impact. Local extension can also occur into the esophagus or the duodenum. Duodenal extension is principally through the muscular layer by direct infiltration and through the subserosal lymphatics, but is not generally of great extent. Extension into the esophagus occurs primarily through the submucosal lymphatics.

Lymph node metastases are found in up to 18% of pT1 lesions after R0 resection increasing to 60% in pT2 lesions. The highest incidence of lymph node metastases are seen in diffusely infiltrating tumors. Tumors located at the gastro-oesophageal junction also have a higher incidence compared to other sites. The pattern of lymph node involvement is dictated by the location of the primary tumour.

Clinical Presentation and Pretreatment Evaluation

Signs and Symptoms

Carcinoma stomach usually presents with only vague symptoms such as weight loss, anorexia, fatigue, or epigastric discomfort. Hence, most patients present with advanced-stage disease.

- Most of the patients have more than 10% weight loss at presentation. Patients with significant weight loss had a significantly shorter survival than those without weight loss.

- Dysphagia may be indicative of a cardiac location with extension through the gastro- oesophageal junction.

- Early satiety may be present in diffusely infiltrative tumors as a result of loss of distensibility of the stomach wall.

- Persistent vomiting is indicative of pyloric obstruction due to antral growth.

- Significant gastrointestinal bleeding while uncommon occurs approximately 10% to 15% of patients. Melena however is a much more common symptom. Anaemia due to persistent microscopic/ gross bleed is a very common sign.

- Ascites, jaundice, or a palpable mass indicates locally advanced or metastatic disease. Due to proximity of the transverse colon, it may be infiltrated by gastric malignancy causing a gastrocolic fistula and obstruction.
- Peritoneal seedling can result in bilateral large ovarian secondaries (Krukenberg's tumor) or pelvic deposits (Blumer's shelf) as evident by pelvic or rectal examination.
- Nodular metastases in the subcutaneous tissue around the umbilicus (Sister Mary joseph’s nodule) or in peripheral lymph nodes represent areas in which a tissue diagnosis can be established with minimal morbidity.

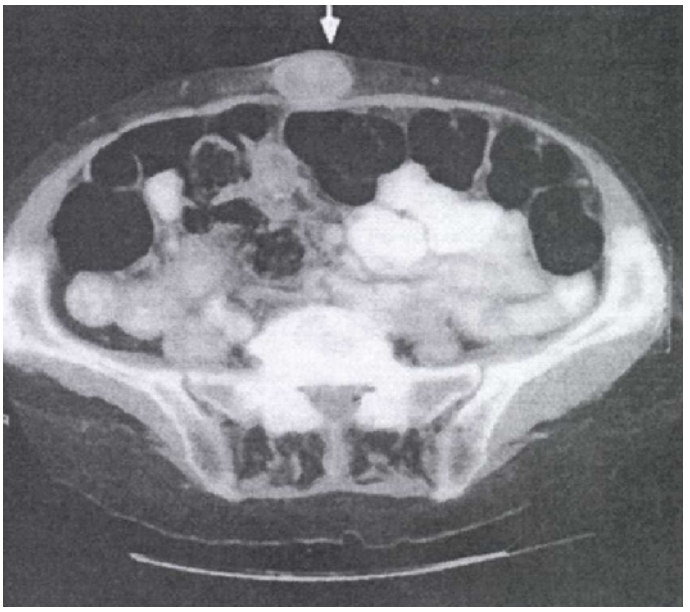


Fig 5: *Umbilical nodule (Sister Mary joseph's nodule)*

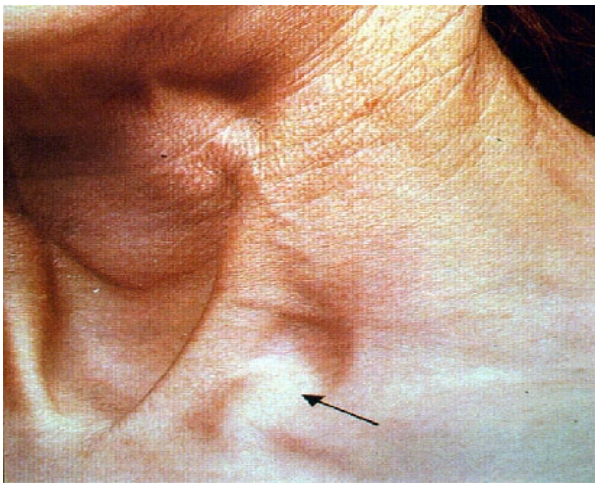


Fig 6: *Virchow's node*

Screening

Mass screening programs for gastric cancer have been most successful in high-risk areas, especially in Japan (1). A variety of screening tests have been studied in Japanese patients, with a sensitivity and specificity of approximately 90%. Screening typically includes the use of double-contrast barium radiographs or upper endoscopy (2).

Pretreatment Staging

Tumor Markers-

The carcinoembryonic antigen (CEA) level is elevated in approximately one third of patients with primary gastric cancer. Though the sensitivity of CEA as a marker of gastric cancer is low, when elevated, it generally correlates with stage.

Combining CEA with other markers, such as the sialylated Lewis antigens CA 19-9 or CA 50, can increase the sensitivity compared with CEA alone (3).

Endoscopy-

Endoscopy is considered to be the best method to diagnose gastric cancer. It directly visualizes the gastric mucosa and helps define the type of gastric cancer, allows assessment of the proximal and distal extent of

disease, assess distensibility of the stomach walls, helps detect satellite lesions and allows biopsy of tissue for a histologic diagnosis.

EUS (2) is used to further stage previously diagnosed tumors. It has the capability to evaluate the deeper layers of the gastric wall to help define the T stage of the tumor and provide information on the morphologic status of surrounding lymph nodes. EUS has an accuracy of up to 90% for T staging of gastric tumors and 75% for N staging; these rates are higher than those for preoperative computed tomography (CT) scans.EUS may also be helpful in identifying early diffuse-type gastric carcinoma lesions that might be otherwise overlooked.

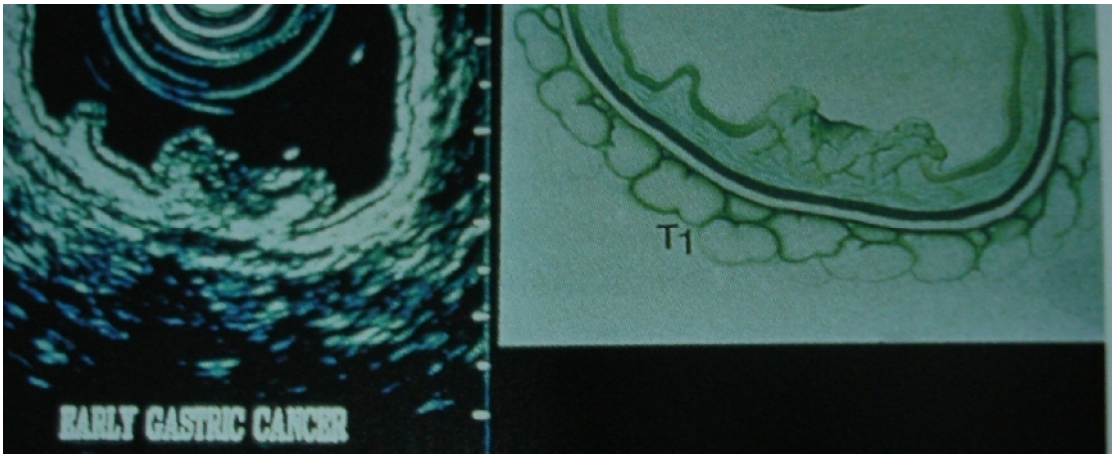


Fig 7: Endoultrasound – tumour invading muscularis

Computed Tomography-

Once gastric cancer is suspected, CT of the abdomen and pelvis is an important part of the staging evaluation. Patients with Siewert's type I or II tumors (see below) should also undergo a chest CT. CT is useful for noninvasive assessment of perigastric lymphadenopathy, peritoneal disease, and intra-abdominal visceral (primary liver) metastatic disease and for estimation of the degree of tumor penetration through the gastric wall. With modern multiphase, multidetector spiral CT imaging, there is increased accuracy in the assessment of extragastric disease and mural penetration (particularly for T2 and greater tumors). The accuracy of CT assessment of tumor location and T stage can be enhanced over that of conventional helical CT by use of water as an oral contrast agent (helical hydro-CT).

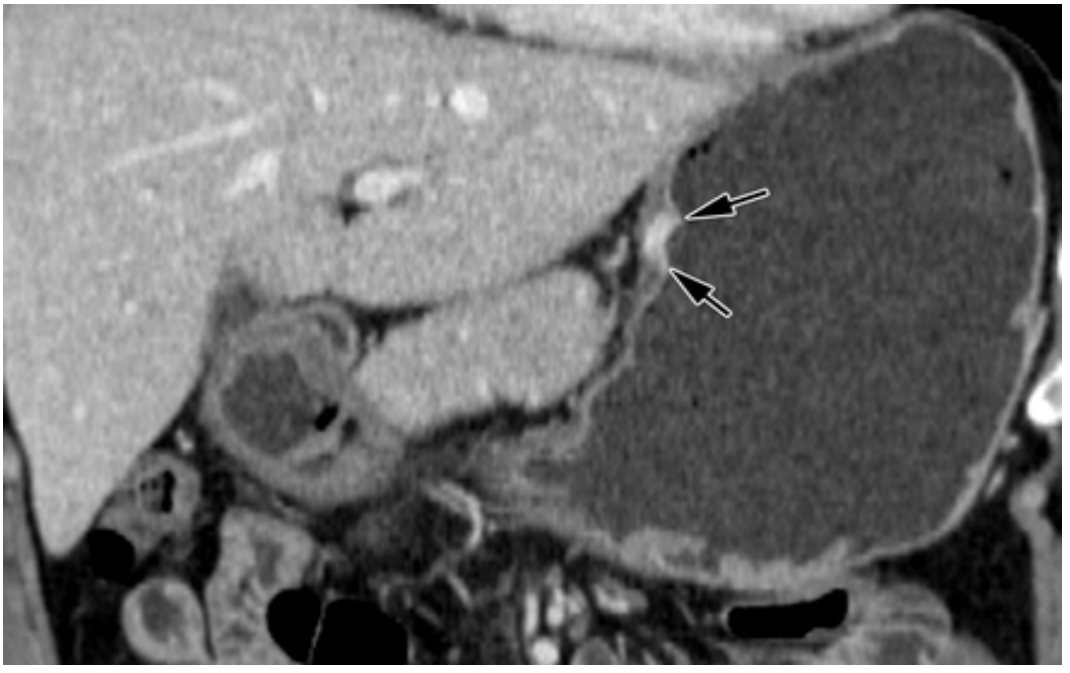


Fig 8: CECT showing an early gastric cancer

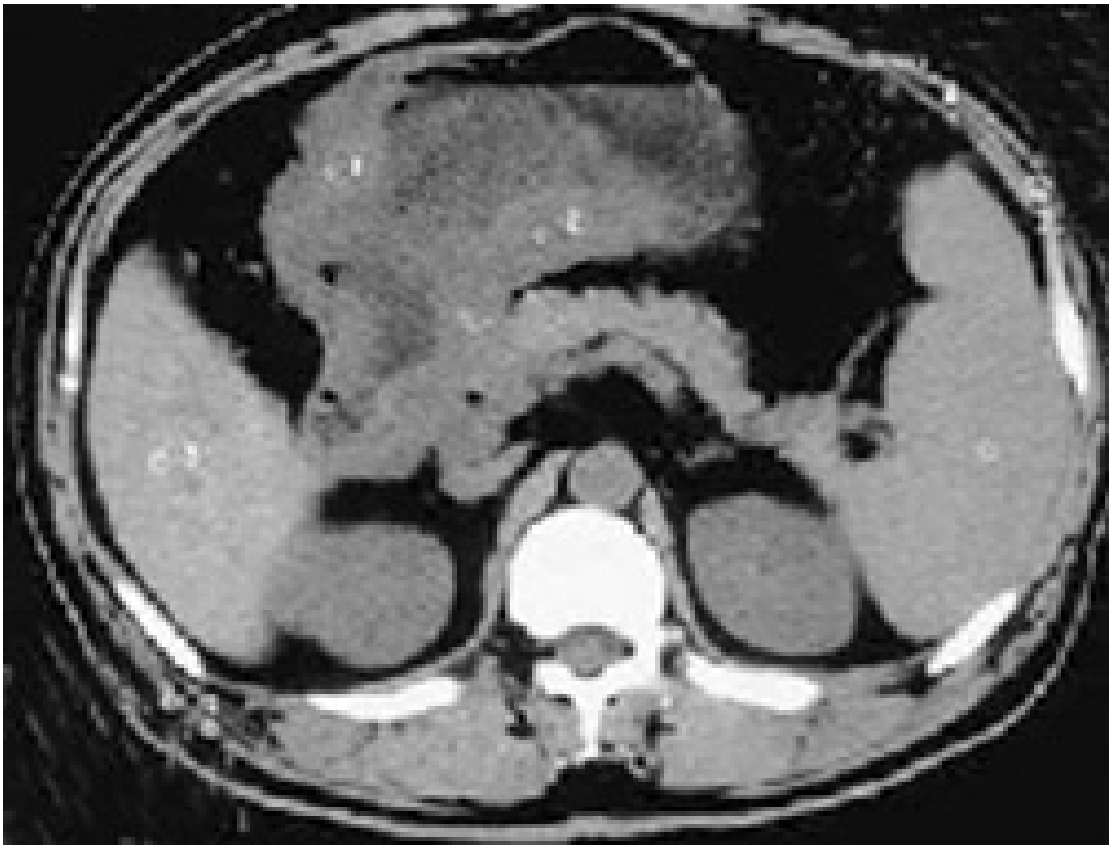


Fig 9: CECT showing a locally advanced gastric cancer

Fig 10: CECT of a T2 lesion of stomach

Positron Emission Tomography(4)-

The role of whole body 2-[18F]-fluoro-2-deoxyglucose (FDG) positron emission tomography (PET) in the management of gastric cancer is currently uncertain. A significant proportion of primary tumors are not FDG avid. This may be in part due to the fact that the glucose transporter-1, an important transporter of FDG into tumor cells, is rarely present is common subtypes of gastric carcinoma, including signet ring cell carcinoma and mucinous adenocarcinoma. FDG-PET CT scans does not help identify occult peritoneal disease, though it does detect extraperitoneal M1 disease.

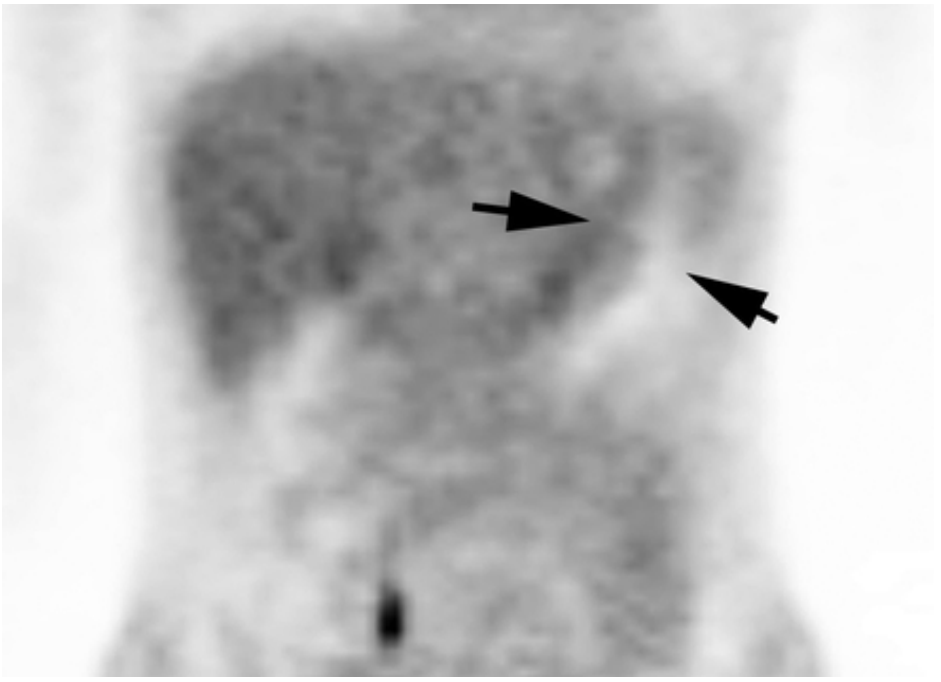


Fig 11: Positron Emission Tomography

Laparoscopy -

Staging laparoscopy is an integral part of the pretreatment staging evaluation of patients felt to have localized gastric cancer after initial helical CT assessment. This is because the sensitivity of CT for detection of extragastric disease declines with the size of metastases.

Laparoscopy allows for direct inspection of the peritoneal and visceral surfaces for detection of CT-occult small volume metastases. Staging laparoscopy also allows for assessment of peritoneal cytology and intraperitoneal evaluation with adjunctive diagnostic techniques such as laparoscopic ultrasound. The rate of detection of CT-occult M1 disease by laparoscopy ranges from 13% to 37% and is dependent on the quality of CT scanning and interpretation (5,6,7). However, the extent of laparoscopic evaluation and the use of laparoscopic ultrasound are unresolved staging issues (8,9).

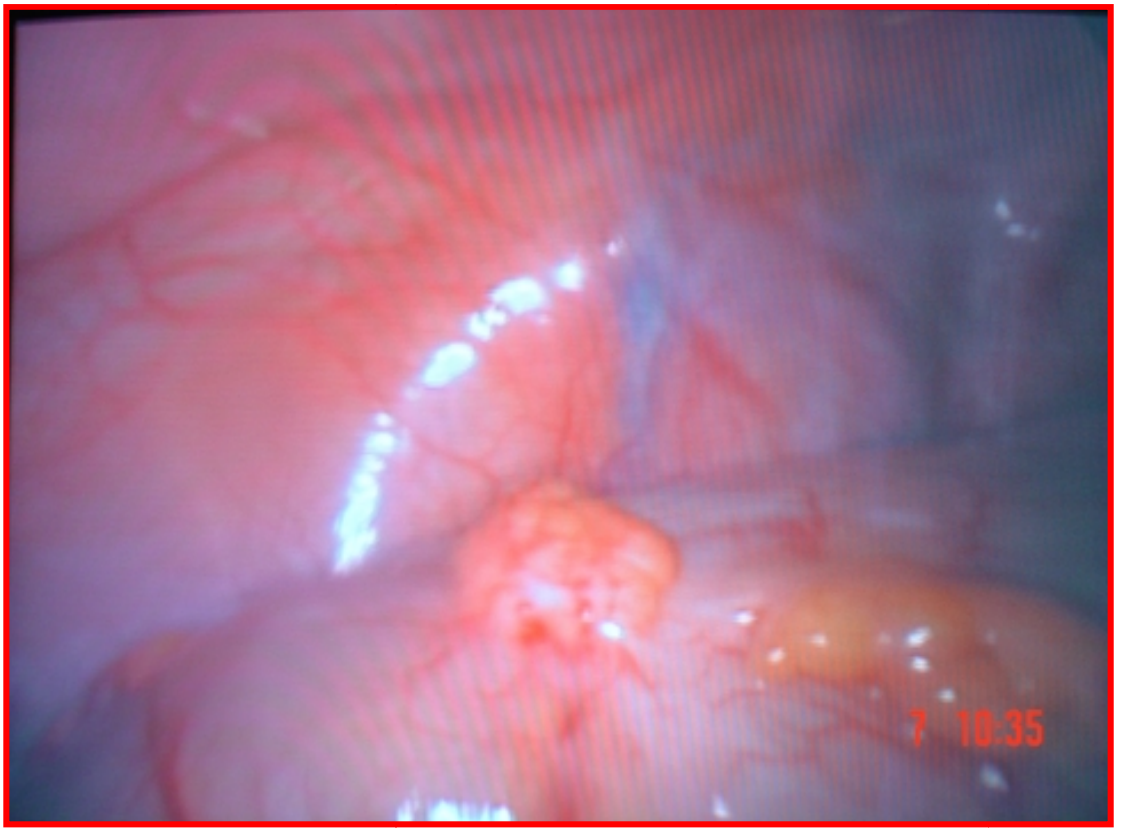


Fig12: Diagnostic laparoscopy

Staging, Classification, and Prognosis

Uniform and accurate staging of cancer is essential to meaningfully predict prognosis and assess outcome. For patients with surgically treated gastric adenocarcinoma, both pathologic staging (International Union Against Cancer [UICC] or Japanese system) and classification of the completeness of resection (R) should be done (10).

In addition, the histopathologic grade and type and the peritoneal lavage cytology status should be recorded. The latter is important because the presence of free peritoneal cancer cells has been shown by a number of investigators to carry a prognosis comparable to that of visceral metastatic disease.

The UICC TNM staging system for gastric cancer is outlined below Table 1. In the AJCC/UICC staging system, tumor (T) stage is determined by depth of tumor invasion into the gastric wall and extension into adjacent structures. The relationship between T stage and survival is well defined.

Nodal stage (N) is based on the number of involved lymph nodes, a criterion that may predict outcome more accurately than the location of involved lymph nodes (12,13). The use of numerical thresholds for nodal classification has become increasingly more accepted. The threshold approach is based on observations that survival decreases as the number of metastatic lymph nodes increases (14,15). Given the reliance on numerical thresholds for nodal staging, it is extremely important that surgeons and pathologists work together to ensure that adequate numbers of lymph nodes are retrieved and examined (16,17).

PRIMARY TUMOR (T)

TX	Primary tumor cannot be assessed
T0	No evidence of primary tumor
Tis	Carcinoma *in situ*: intraepithelial tumor without invasion of the lamina propria
T1a	Tumor invades lamina propria or muscularis mucosae
T1b	Tumor invades submucosa
T2	Tumor invades muscularis propria
T3	Tumor invades subserosa
T4a	Tumor penetrates serosal (visceral peritoneum) without invasion of adjacent structures
T4b	Tumor invades adjacent structures

REGIONAL LYMPH NODES (N)

NX	Regional lymph node(s) cannot be assessed
N0	No regional lymph node metastasis
N1	Metastasis in 1 to 2 regional lymph nodes
N2	Metastasis in 3 to 6 regional lymph nodes
N3a	Metastases in 7 to 15nodes
N3b	Metastases in 16 or more nodes

DISTANT METASTASIS (M)

M0	No distant metastasis
M1	Distant metastasis

Stage 0	Tis	N0	M0
Stage IA	T1	N0	M0
Stage IB	T2	N0	M0
	T1	N1	M0
Stage IIA	T3	N0	M0
	T2	N1	M0
	T1	N2	M0
Stage IIB	T4a	N0	M0
	T3	N1	M0
	T2	N2	M0
	T1	N3	M0
Stage IIIA	T4a	N1	M0
	T3	N2	M0
	T2	N3	M0
Stage IIIB	T4b	N0 or N1	M0
	T4a	N2	M0
	T3	N3	M0
Stage IIIC	T4b	N2 or N3	M0
	T4a	N3	M0
Stage IV	Any T	Any N	M1

Table 1: UICC staging of gastric cancer

Ratio-based lymph node classification ratio of metastatic to uninvolved lymph nodes –(RML) may minimize the confounding effects of regional variations in the extent of lymphadenectomy and in pathologic evaluation of the lymphadenectomy specimen on lymph node staging and thereby reduce the impact of stage migration. RML was found to be an independent prognostic factor for survival and reduced the frequency of stage migration (18).

Japanese Staging System (19)

The most recent Japanese Classification for Gastric Carcinoma was published in 1998. The Japanese classification and staging system is more detailed than the AJCC/UICC staging system and places more emphasis on the distinction between clinical, surgical, pathologic, and final staging (prefixes c, s, p, and f respectively) (Table 2).

In addition to lymph node compartments, it also reports presence or absence of hepatic (H), distant metastases (M), peritoneal metastases (P) and peritoneal cytology (CY) in addition to proximal and distal margins (PM and DM respectively), For example, a surgically treated and staged patient with locally advanced, nonmetastatic gastric cancer might be

staged as pT3, pN2, sH0, sM0, f stage IIIB (where H0 denotes no hepatic metastases and the f prefix denotes final clinicopathologic stage).

Clinical findings (C)	Surgical Findings (s)	Pathological Findings (p)	Final Findings (f)
Physical examination Diagnostic imaging Endoscopy and biopsy Diagnostic laparoscopy, Biopsy and cytology Biochemical and/or biological examination Others (genetic studies)	Operative findings Intraoperative diagnostic imaging Intraoperative cytology Frozen sections	Pathological examination of materials obtained only by surgical, endoscopic, or laparoscopic resection	Comprehensive summary of findings based on clinical, surgical and pathological findings

Table 2: Principles of recording

Similar to the UICC staging system, primary tumor (T) stage in the Japanese system is based on the depth of invasion and extension to adjacent structures, as outlined in Table 4. However, the assignment of lymph node (N) stage involves much more rigorous pathologic assessment than is required for UICC staging. As mentioned earlier in the section on lymphatic spread, the Japanese system extensively classifies 18 lymph node regions into four N categories depending on their relationship to the primary tumor and anatomic location.

The Japanese staging system (table 3) also includes elements not included in the AJCC/UICC system. These are macroscopic description of the tumor (early gastric cancer subtype or Borrmann type for more advanced tumors), extent of peritoneal metastases (classified as P0-1),

extent of hepatic metastases (H0-1), and peritoneal cytology findings (CY0-1). The comprehensive c, s, p and f prefix system used in the Japanese system provides a succinct and accurate summary of an individual patient's extent of disease.

TUMOR STAGE	
T1	Tumor invasion of mucosa and/or muscularis mucosa (M) or submucosa (SM)
T2	Tumor invasion of muscularis propria (MP) or subserosa (SS)
T3	Tumor penetration of serosal (SE)
T4	Tumor invasion of adjacent structures (SI)
TX	Unknown
NODAL STAGE	
N0	No evidence of lymph node metastasis
N1	Metastasis to group 1 lymph nodes, but no metastasis to groups 2 to 3 lymph nodes
N2	Metastasis to group 2 lymph nodes, but no metastasis to group 3 lymph nodes
N3	Metastasis to group 3 lymph nodes
NX	Unknown
HEPATIC METASTASIS STAGE (H)	
H0	No liver metastasis
H1	Liver metastasis
HX	Unknown
PERITONEAL METASTASIS STAGE (P)	
P0	No peritoneal metastasis
P1	Peritoneal metastasis
PX	Unknown
PERITONEAL CYTOLOGY STAGE (CY)	
CY0	Benign/indeterminate cells on peritoneal cytology[a]
CY1	Cancer cells on peritoneal cytology
CYX	Peritoneal cytology was not performed
OTHER DISTANT METASTASIS (M)	
M0	No other distant metastases (although peritoneal, liver, or cytological metastases may be present)
M1	Distant metastases other than the peritoneal, liver, or cytological metastases
MX	Unknown

Table 3: Japanese Gastric cancer association staging system

Resection Classification

The R classification system indicates the amount of residual disease left after tumor resection (20). R0 indicates no gross or microscopic residual disease; R1 indicates microscopic residual disease, and R2 signifies gross residual disease. The R classification has implications for individual patient care and clinical research. Surgeons should wait for the final pathology results before completing their operative summaries so that patient records include the R classification for the gastrectomy. Results of clinical trials that include surgery should include information on R status.

Predicting Individual Patient Prognosis

Kattan et al.(21) have developed a nomogram for estimating 5-year disease-specific survival using established prognostic factors derived from a population of 1,039 gastric cancer patients treated by R0 surgical resection at a single institution (www. nomograms.org). Clinicopathologic factors incorporated in the nomogram include patient age and gender, primary tumor site, Lauran classification, tumor size and depth, and the numbers of positive and negative lymph nodes. This tool may be useful for individual patient counseling, follow- up scheduling,

and clinical trial eligibility assessment and is available for personal hand-held computer devices at www.nomograms.org.

Treatment of Early gastric cancer (Stage I)

Treatment Options for Early gastric cancer include Endoscopic mucosal resection (EMR), Limited surgical resection and Gastrectomy. Endoscopic mucosal resection (EMR) is offered only to patients with low lymph node metastatic potential i.e well differentiated, < 3 cm, superficial Type II a or Type II c lesions in conducive location. It can be done by several methods - Saline lift technique or Cap suction / cut and ligate method. The criteria for limited surgical resection is the same as for EMR, but this procedure is done for difficult locations. For poorly differentiated tumours, size > 3 cm with penetration to submucosa and beyond, gastrectomy should be done. However, if the patient with EGC is unfit for gastrectomy, EMR can be done.

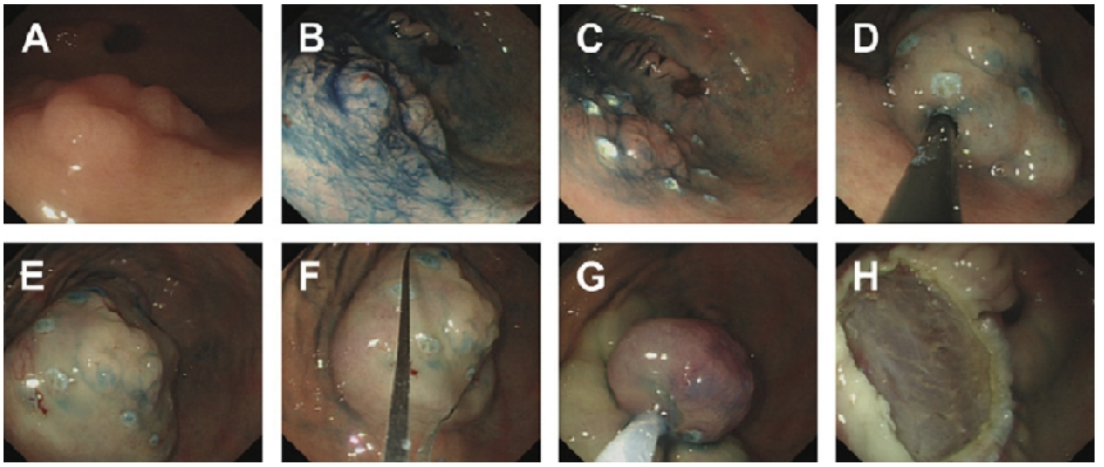


Fig 13: EMR – Lift and snare technique

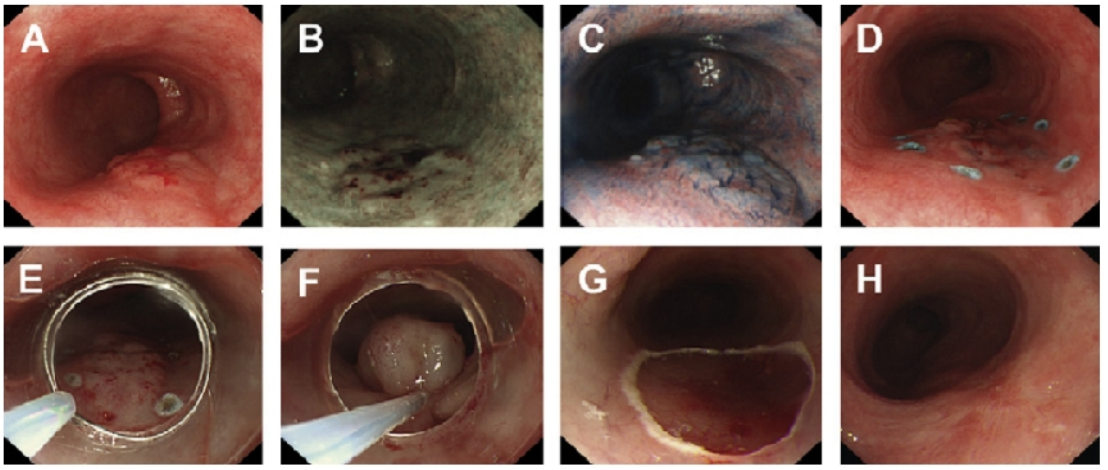


Fig 14: EMR – Cap technique

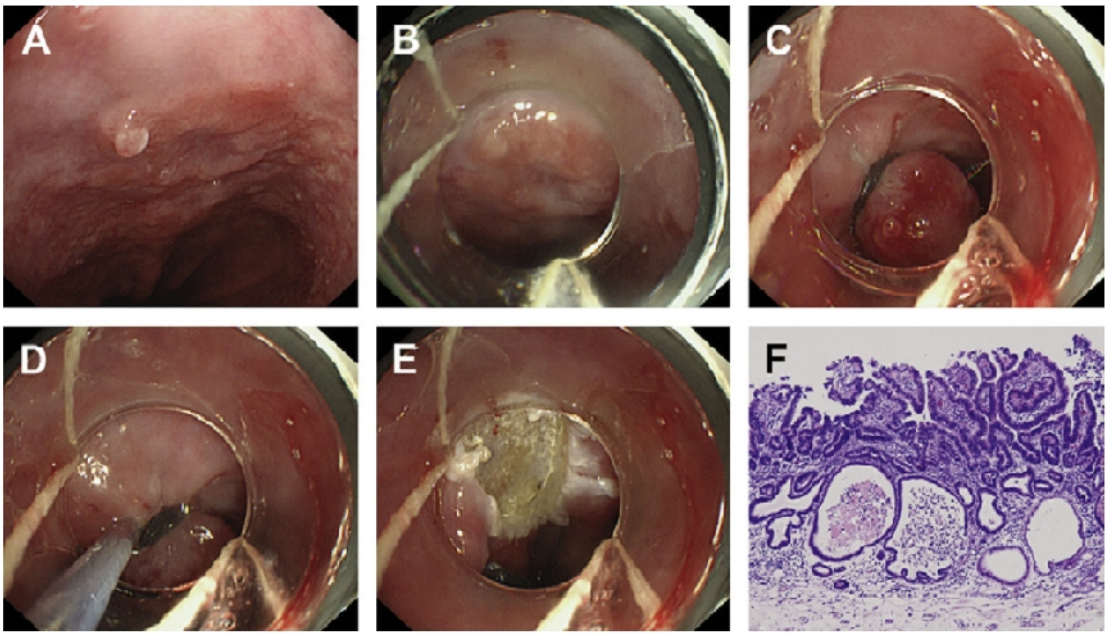


Fig 15: EMR - Multiband mucosectomy technique

There is no consensus regarding the extent of lymphadenectomy in EGC. D 0 dissection with lymph node sampling, sentinel node sampling are being explored. However, Dissection of group 1 lymph nodes seems to be the standard at present.

Treatment of locally advanced gastric cancer (Stage II and III)

Surgery (22)

Poor performance status, presence of supraclavicular or axillary nodes, periumbilical nodules, malignant ascitis, peritoneal and hepatic metastases are indicators of inoperability.

Surgical R0 resection is the cornerstone of treatment for patients with localized gastric cancer. Three features need to be emphasized when discussing gastrectomy for cancer. These include

a. Omental bursectomy

b. Extent of gastrectomy

c. Extent of lymphadenectomy

Extent of gastrectomy:

The extent of gastrectomy required for satisfactory primary tumor treatment depends on

a): the gross and microscopic status of surgical margins and

b): on the extent/ level of lymphadenectomy required.

For most clinical situations, a 5-cm grossly negative margin around the tumor and microscopically negative surgical margins (R0) are the treatment goals. When the general oncologic goal of an R0 resection can be achieved by partial gastrectomy, it is preferred over total gastrectomy to minimize the risks of specific sequelae of total gastrectomy such as early satiety, weight loss, and the need for vitamin B12 supplementation.

Many surgeons advocate a transabdominal resection of the lower esophagus and proximal stomach or total gastrectomy for a Siewert's types II or III cancer . Surgeons trained in thoracic surgery have frequently advocated a combined abdominal and thoracic procedure (often termed oesophagogastrectomy) with an intrathoracic or cervical anastomosis between the proximal esophagus and the distal stomach or a procedure termed transhiatal (or blunt) oesophagectomy (THE), which involves resection of the esophagus and oesophagogastric junction with mediastinal dissection performed in a blunt fashion through the esophageal hiatus of the diaphragm.

Until additional RCTs are performed, the surgical approach to these patients should be individualized and determined surgeon factors (training and experience), patient factors (age, comorbidity, and performance status), and tumor factors (pretreatment T and N stage).

In addition, for cancers at all sites, the extent of gastric resection will also be guided by the extent of devascularisation of the stomach caused by the lymphadenectomy performed.

Extent of Lymphadenectomy

The extent of lymphadenectomy depends on three issues: a): the frequency of involvement of lymph nodes at specific stations based on the location of the primary cancer. b): staging removal and histopathologic analysis of an adequate number of lymph nodes that will predict with accuracy the extent of lymph node and distant metastases. c): possibility of some forms of lymphadenectomy being therapeutic for patients with gastric cancer.

The number of pathologically positive lymph nodes is of prognostic significance and removal and pathologic analysis of at least 15 lymph nodes is required for adequate pathologic staging which is reflected in the UICC staging rules for gastric cancer. Multidisciplinary approach mandates 1: surgeons perform an adequate lymphadenectomy, and 2: pathologists retrieve and examine at least 16 lymph nodes to provide optimal pathologic staging.

The possible therapeutic benefit of extended lymph node dissection has been studied in randomized clinical trials (23,24,25,26,27) There are in addition reports from retrospective and non-randomised studies involving over 5000 patients from Japan. Extended lymph node dissections (D2) improve disease specific survival and locoregional control. This also carries an increased risk for postoperative mortality, morbidity and reoperation. With the acceptance of the a safer, spleen-preserving D2 resection technique in high-volume centres, D2 lymphadenectomy is the recommended surgical approach for patients with resectable (curable) gastric cancer (28).

Extended gastric resections (adjacent organs):

En-bloc resection of the transverse colon if the colon or adjacent mesocolon is involved adds little to post operative morbidity and mortality. It improves local disease control and quality of life and might impact positively on survival. Routine distal pancreatectomy and splenectomy as part of D2 dissection for proximal cancer does not improve survival. On the other hand they have added to operative morbidity, early surgical mortality and impacted negatively on long term survival (29). Pancreatic and splenic resections are justified only when there is direct tumour infiltration.

Individualized Assessments of Lymph Node Involvement

Since extended lymphadenectomy carries an increased risk of morbidity and mortality, attention has focused on methods of individual assessment of risk of lymphatic spread. These techniques offer the possibility of tailoring surgical therapy for an individual patient. At present three approaches to individual nodal risk assessment have been evaluated: computer modeling, preoperative endoscopic injection, and sentinel lymph node biopsy. These methods are investigational currently.

Impact of high surgical volume on outcomes.

As in other surgical procedures, a clear relationship has been demonstrated between institutional gastrectomy volume and perioperative mortality rates. Gastrectomy at high- volume centers was associated with the lowest surgical mortality, shortest duration of hospital stay and the lowest readmission rates.

The variations in gastrectomy related mortality rates may be related in part to surgeon training and experience with the procedure (30,31,32).

Outcome in Japan Versus Western Countries

Stage-stratified survival rates for gastric adenocarcinoma are higher in Japan than in most Western countries. The better-prognosis intestinal-type (Lauran classification25) tumors (due to a higher incidence of H. pylori infection and atrophic gastritis) are seen more commonly in Japan, whereas the diffuse-type cancers that are associated with a poorer prognosis are more frequent in Western series. Poorer-prognosis proximal gastric cancers are less frequent in Japanese than in Western populations (33) and the increase in proximal gastric cancers observed in the West has not been observed in Japanese populations (34).

Regional differences in the diagnostic criteria for EGC also may contribute to regional differences in observed outcome. In Japan, gastric carcinoma is diagnosed based on its structural and cytologic features without consideration of invasion of the lamina propria. In contrast, Western pathologists consider invasion of the lamina propria to be an essential element of the diagnosis of carcinoma (35,36). As a consequence, unequivocally neoplastic noninvasive lesions are classified as carcinoma in Japan but as dysplasia by Western pathologists.

Stage migration is a well-documented factor contributing to the stage-specific differences in outcome between Japanese and Western patients (37). Widespread use of extensive D2 or D3 lymphadenectomy combined with rigorous pathologic assessment of the lymphadenectomy specimen in Japan results in more accurate stage assignment of Japanese patients. This leads to secondary stage migration and improvement in stage-specific survival without improvement in overall survival.

In addition, genetic, environmental, and biologic differences may also contribute to the better survival of Japanese patients (38).

Technical points in performing a gastrectomy and D2 dissection (33)

Once distant metastases have been ruled out by laparoscopy, a bilateral subcostal incision or a midline abdominal incision can be used to gain exposure to the upper abdomen. The peritoneal cavity is examined again and peritoneal fluid/ wash sample is collected for cytology. The stomach should be inspected to assess the location and extent of tumor. The size and location of the primary tumor dictate the extent of gastric resection.

A D2 lymphadenectomy sparing the spleen and pancreas can be done safely and provides an adequate specimen for surgical and pathologic staging. This procedure should only be performed by or with

an experienced surgeon.

The D2 subtotal gastrectomy commences with mobilization of the greater omentum by incising the fourth layer of the greater omentum along its attachment with the transverse colon (Fig 5).

This leads to the potential space between the third and fourth layers of omental bursa on the transverse mesocolon along the upper border of the colon, the middle colic vessels are left behind on the fourth layer.

This plane is developed down to the head of the pancreas where the infrapyloric lymph nodes are dissected, and the origin of the right gastroepiploic artery and vein ligated.

With a combination of blunt and sharp dissection, the plane of dissection continues on to the anterior surface of the pancreas, extending to the level of the common hepatic and splenic arteries. This maneuver provides protection against serosal spread of tumor to the lesser sac peritoneal surface.

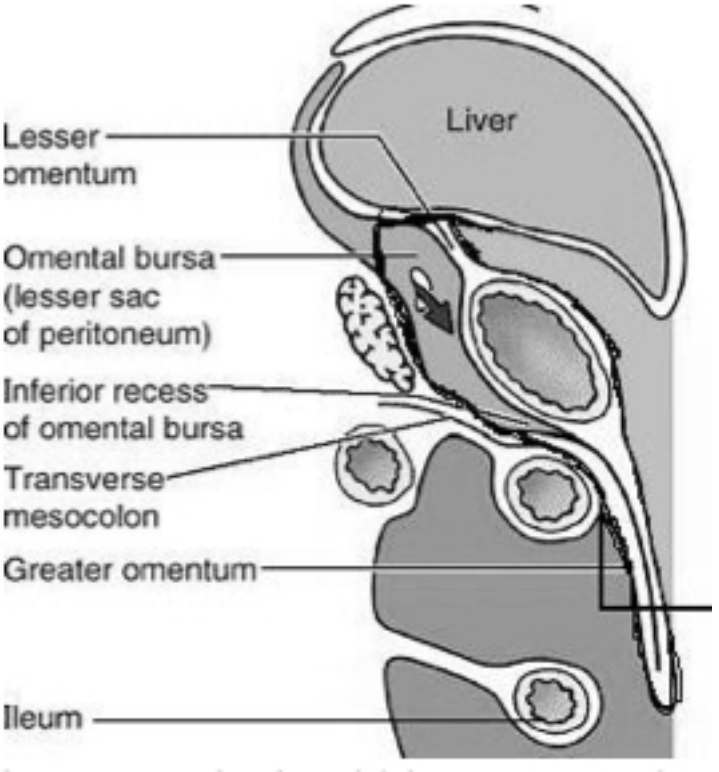


Fig 16: Showing line of dissection for omental bursectomy

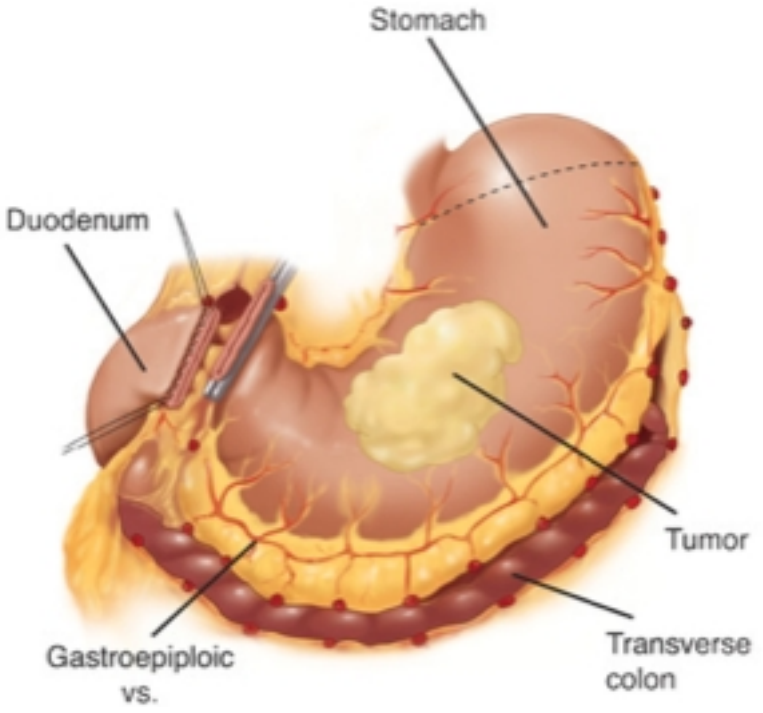
The right gastric artery is ligated. At this point, the duodenum is divided distal to the pylorus.

The stomach and omentum are then reflected cephalad. The gastrohepatic ligament is divided close to the liver up to the gastro-oesophageal junction. Dissection is then continued on the hepatic artery toward the celiac axis. Once near the celiac axis, the lymph node bearing tissue is dissected until the left gastric artery is visualized and can be divided at its origin. During this process the coronary vein is also ligated.

The proximal peritoneal attachments of the stomach and distal esophagus can then be incised, and the proximal extent of resection is chosen.

For tumors of the mid- and proximal stomach, dissection of the lymph nodes along the splenic artery and splenic hilum is important. This is not indicated for antral tumors.

The stomach is then divided 5 cm proximal to the tumor, which dictates the extent of gastric resection. Despite the fact that the entire blood supply of the stomach has been interrupted, a cuff of proximal stomach invariably shows good vascularization from the feeding distal esophageal arcade.



It is safer to anastomose jejunum to stomach versus esophagus because of the technical ease and excellent healing. Reconstruction using a variety of techniques has been described.

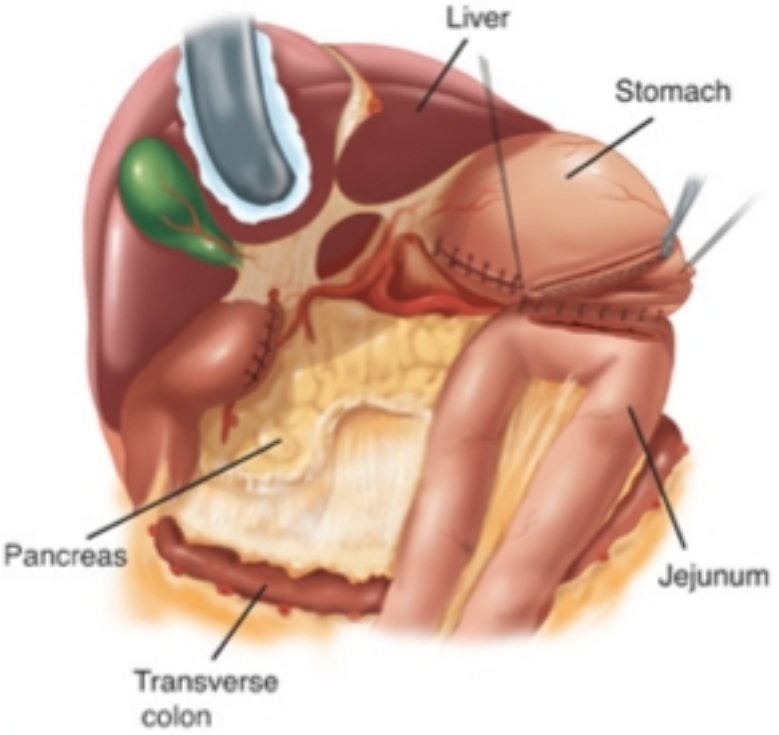


Fig 17: Subtotal gastrectomy with Gastrojejunostomy

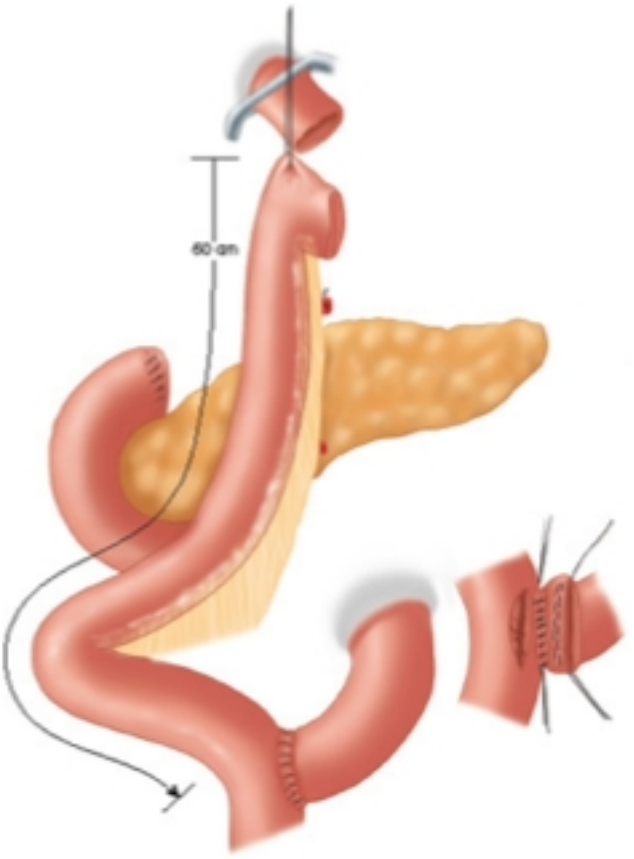


Fig 18: A Total gastrectomy done for proximal gastric cancers following which reconstruction is done by a Roux-en-y esophago-jejunostomy

Adjuvant Therapy

The high risk for recurrence with surgery alone for advanced resectable gastric cancer has led to extensive investigation of the use of postoperative adjuvant, and more recently, perioperative systemic therapy.

The term adjuvant therapy is best used to describe additional treatment in an attempt to increase cure rates in patients who have already undergone an R0 resection. The term perioperative chemotherapy (or neoadjuvant chemotherapy) involves the use of systemic treatment before definitive, potentially curative surgery.

Adjuvant therapy should commence as soon after operation as is practical. Preclinical studies have shown a rapid increase in cell growth of metastatic lesions after a primary tumor has been removed due to a decline in circulating factors that block angiogenesis or other cell cycle promoters. Neoadjuvant chemotherapy is thus an attractive concept for patients with advanced gastric cancer, with a dual goal of decreasing the stage/ volume of the primary tumor thus allowing a higher rate of R0 resections, and early treatment of micrometastatic disease.

Adjuvant Postoperative Systemic Therapy

The results of most trials conducted till date do not show any benefit for postoperative multiagent chemotherapy. Most of these have been underpowered. Five meta-analysis (39,40,41,42) published till date have indicated modest benefits of about 4%. However these did not analyse individual data. Trials with large number of patients will be needed before any recommendations can be made.

The most active agents seem to be 5 FU and its derivatives, cis-platin, oxaliplatin, the anthracyclines doxorubicin and epirubicin and the taxanes. Immunochemotherapy using either protein-bound polysaccharide (PSK) or a Streptococcus pyrogenes preparation, OK432 has been tried with little benefit (43). More recently, trastuzumab has been approved for adjuvant therapy along with chemotherapy in Her2neu positive gastric cancers (44).

Adjuvant Intraperitoneal Chemotherapy (45)

Peritoneal recurrence is a common failure occurring in patients with gastric cancer. The rationale for the use of intraperitoneal treatment is based on the pharmacokinetic observation that drug concentrations within the peritoneal cavity after intraperitoneal administration are much higher than those achievable intravenously or orally. In ovarian cancer, a small

but statistically and clinically significant advantage in survival has been reported in large-scale trials for women who received at least a portion of their therapy delivered intraperitoneally. While preclinical models in gastric cancer support this observation, no definitive conclusions can yet be drawn regarding the effectiveness of intraperitoneal postoperative chemotherapy in this setting. Most centres report intraperitoneal chemotherapy using either heated solutions (continuous hyperthermic peritoneal perfusion, or CHIP) or nonhyperthermic treatment given either immediately or instituted within several days of resection through intraperitoneal catheters place at the time of surgery.

Neoadjuvant Chemotherapy

The landmark MAGIC trial (46) demonstrated an advantage of systemic treatment plus operation when compared to operation alone. There was a shift to an earlier stage overall in patients receiving perioperative chemotherapy, as well as an improved R0 resection rate. With a median follow-up of 4 years, there was a significant improvement both in disease- free and in overall survival for patients receiving perioperative chemotherapy: 5-year survival rate was 36% for those receiving chemotherapy and 23% for those receiving surgery alone (HR 0.75; 95% CI, 0.6 to 0.9; P = .009).

Adjuvant Radiation and Chemoradiation Therapy

Several studies have demonstrated a benefit of adjuvant chemoradiation for both overall survival and locoregional disease control (47,48). These have however not had rigid control over the surgical procedure. There is an understanding that chemoradiation probably offsets the adverse effects of inadequate surgery. Studies that plan to include the type of surgery before randomization will be needed to settle this issue. Radiation therapy alone (including intraoperative radiation therapy – IORT) has not been shown to be of benefit over surgery alone.

Treatment of unresectable/ metastatic Disease (Stage IV)

Chemotherapy versus Best Supportive Care (49)

The results of studies and supportive evidence from recent trials with palliative combination chemotherapy and best supportive care indicate that patients with advanced incurable gastric cancer who are in good performance status and can tolerate potential toxicities have a modest benefit in survival, time to disease progression and quality of life compared to best supportive care alone. Targeted therapies using the vascular endothelial growth factor inhibitor Bevacizumab, epidermal growth factor or tyrosine kinase inhibitors (cetuximab or geftinib respectively) are showing exciting promise.

Surgery for Palliation

Since survival for patients with advanced gastric cancer is poor, any proposed operation should provide sustained symptomatic relief while minimizing morbidity and need for prolonged hospitalization. The operative mortality for palliative surgery is about 25%, anastomotic dehiscences accounting for a majority of deaths. Frequent symptoms for which surgery is offered include obstruction, hemorrhage, pain, nausea and dysphasia. A gastrojejunostomy palliates patients for a shorter duration compared to a gastrectomy (a mean of 5.9 months compared with 14.6 months). Selection bias is likely to skew the results.

Radiation for Palliation

Radiation therapy, though used less frequently can be offered to palliate pain or hemorrhage.

Long-Term Side Effects of Therapy

The long term consequences of therapy for gastric cancer include the dumping syndromes, malabsorption and resulting weight loss, alkaline reflux and late effects of chemotherapy or radiation therapy including possible second malignancy. Dumping syndromes may occur in one of the two forms –a): vasomotor causing diarrhea and cramping and

palpitations (these can occur very shortly after a meal or 1 to 3 hours later) and can be managed by adjusting the volume of oral intake and other dietary manipulations and b): a reactive hypoglycemia that can result from the rapid insulin release after a meal with little gastric reservoir.

B12 malabsorption is well known resulting from a loss of intrinsic factor. Iron and calcium malabsorption due to elimination of gastric acid and may manifest many years later.

Failure patterns

Gastric cancers recur in multiple sites, both loco-regional and systemic. Reported patterns of failure are somewhat variable.

In the report from MSKCC (50), 496 patients experienced recurrences out of 1,038 patients who underwent R0 gastrectomy with D2 lymphadenectomy. Data on recurrence were available in 367 (74%) patients. Multivariate analysis of the data revealed that female sex, advanced T stage, and distal and diffuse type cancers were associated with peritoneal recurrence while proximal tumours, early T stage, and intestinal type tumors had association with locoregional recurrence.

In another study from Korea, 508 patients developed recurrences out of 2,038 patients treated with potentially curative gastrectomy (51) - 33% involved locoregional sites, 44% were peritoneal, and 38% were distant. It is therefore important to control both loco-regional disease as well as systemic disease to improve long-term results.

Diagnostic Laparoscopy in staging carcinoma stomach

Diagnostic laparoscopy has emerged as an important tool in the staging of gastrointestinal malignancies. It is used as an adjunct to other conventional imaging modalities such as computed tomography (CT), transabdominal ultrasound (USG), magnetic resonance imaging (MRI), positron emission tomography (PET) in order to assess the presence and extent of metastatic disease.

Indications

The common malignant conditions of the abdomen where diagnostic laparoscopy is useful include esophageal carcinoma, gastric cancer, pancreatic cancer, colorectal cancer and Gall bladder / cholangio carcinoma. There have also been instances where patients with melanoma of the trunk or extremities have had metastases to the small bowel, causing unexplained gastrointestinal bleeding or small bowel obstruction. These patients could also benefit from a diagnostic laparoscopy. Patients

with Hodgkin lymphoma could also benefit from a staging laparoscopy to assess and plan for the appropriate chemotherapy and/or radiation therapy.

Indications for laparoscopic staging of abdominal tumors.

- Preoperative staging before major surgical resection
- Assessment of liver or lymph nodal status
- To Confirmation findings of CECT
- Therapeutic decision making for Hodgkin lymphoma
- Proper evaluation of ascitic fluid

The advantage of diagnostic laparoscopy over imaging techniques is that it can not only help in direct visualization but also to biopsy suspicious lesions on liver / peritoneal surface or lymph nodes and also to perform peritoneal lavage. Imaging studies give only indirect evidence of underlying disease.

In tropical countries where infectious diseases such as tuberculosis or parasitic infestation are more common than cancer, laparoscopic examination assists in the differential diagnosis of these entities. Laparoscopy may aid in identification of adhesions as a cause of chronic abdominal pain in patients with history of previous surgeries or with chronic pelvic pain and an adhesiolysis may be beneficial in this group.

Technique of Elective Diagnostic Laparoscopy

Following extensive preoperative diagnostic and staging work up, patients are prepared for a diagnostic laparoscopy. Although, General anesthesia is usually preferred for cancer staging, it can also done under local anesthesia.

The operating table should be able to provide both Trendelenburg and reverse Trendelenburg positions. Both upper and lower abdomen should be completely examined by creating a pneumoperitoneum.

A midline supra- or sub- umbilical incision is made and a 10 mm trocar introduced. The camera used is either a zero or 30- degree camera for complete inspection. Additional 5 mm ports are introduced in right and left upper quadrants for introducing grasping, dissecting or biopsy forceps.

Biopsy may be performed with cupped forceps passed through either a 5- or 10-mm trocar sleeve. Alternatively, cutting biopsy needles may be used to obtain liver or nodal tissue (Fig. 19). The needle biopsy may be performed percutaneously under laparoscopic guidance, or the biopsy needle may be passed through one of the 5 mm trocar sheaths. It is important to perform biopsy cleanly without crushing tissue, since this might reduce the opportunity for pathologic review.

Procedures performed during staging laparoscopy.

- Complete abdominal and pelvic inspection
- Division of gastro hepatic ligament
- Biopsy of suspicious liver or peritoneal nodules
- Peritoneal lavage for malignant cytology
- Ascitic fluid analysis for cytology
- Assessment and sampling of enlarged lymph nodes
- Laparoscopic ultrasonogram

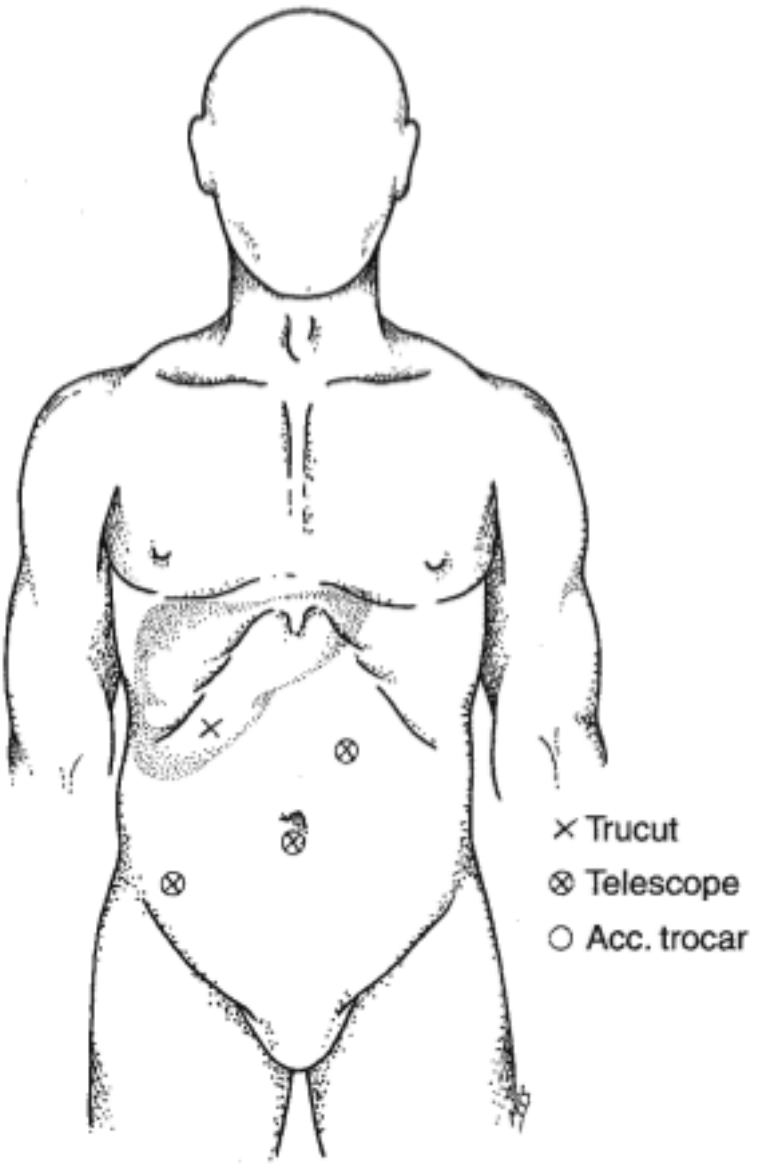


Figure 19: The needle used for taking a liver biopsy can be introduced either through a trocar or percutaneously.

The areas required to be biopsied vary according to the location of the primary cancer and its drainage areas. Lymph nodes are ideally sampled intact in order to achieve good tissue architecture for HPE.

Though surgical resection might be required in most cases of carcinoma stomach, be it for curative or palliative intent, diagnostic laparoscopy may be useful in patients with unresectable and metastatic disease wherein an unnecessary laparotomy can be avoided.

Diagnostic laparoscopy for the preoperative evaluation of gastric carcinoma is done using three ports – a 10 mm umbilical port for the camera and two working ports each 5 mm, if necessary, in each upper quadrants.

1. The patient is placed in steep Trendelenburg position and the assessment is commenced by inspection of the pelvic peritoneum to look for minute peritoneal nodules, which become visible under magnification of the laparoscope.

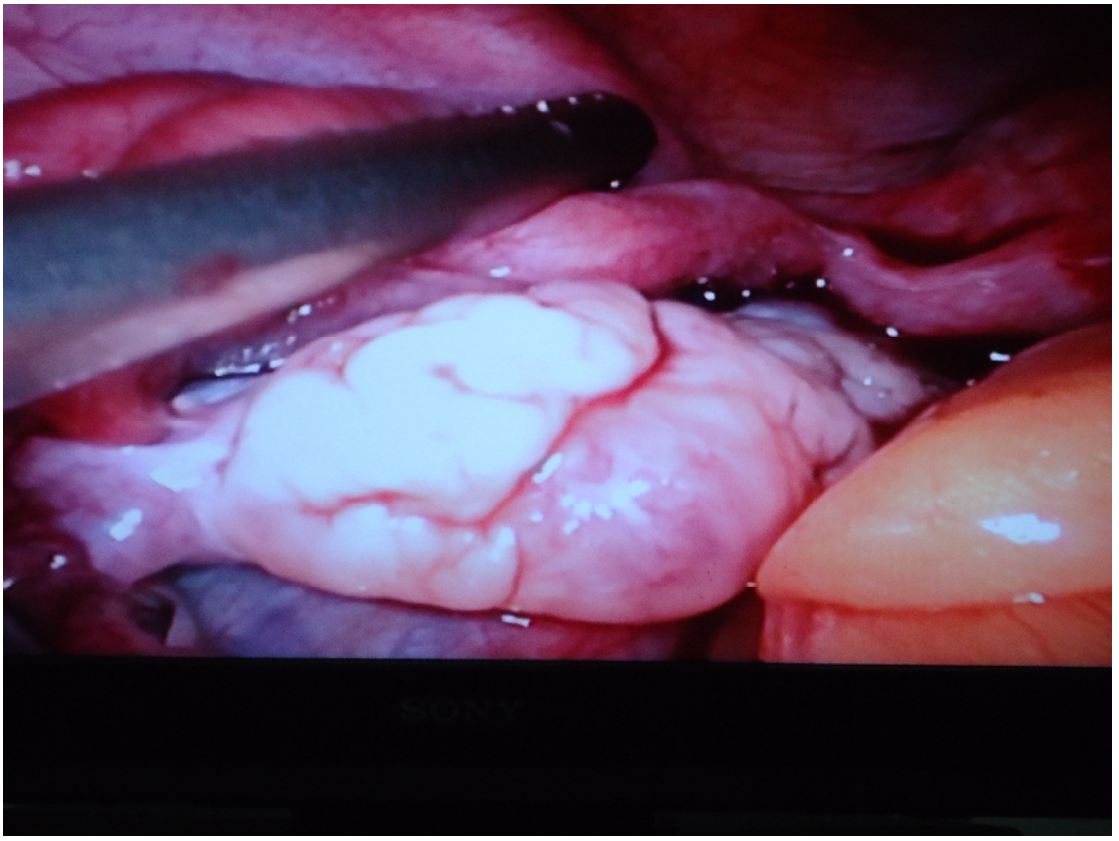


Fig 20: Krukenberg tumour in a patient with Ca stomach

2. The operating table is then turned to a neutral position. The table is rotated alternatively to right and left lateral positions (called “air-planing” the table) in order to look for free fluid which, if present, is aspirated and sent for cytological analysis.

3. The liver is then inspected by turning the table to head down and left tilt. This position allows the liver to fall out of the subdiaphragmatic space. A 45 degree angled scope is then used to inspect all the visible surfaces of the liver. The liver is evaluated for

suspicious nodules or adhesions or plaques, which are biopsied using forceps or needle to look for metastases.

4. Any suspicious nodules on the peritoneal surface or omentum are also biopsied with cupped forceps. Perfect hemostasis is achieved using electrocautery.

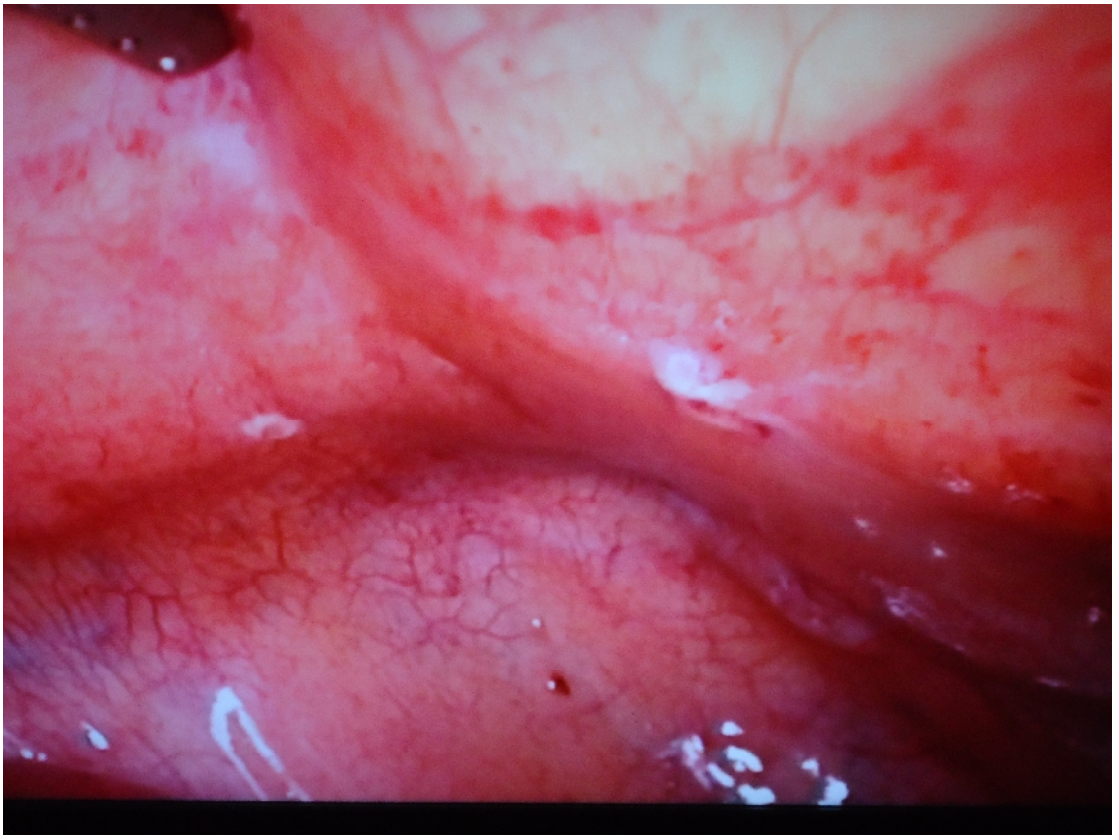


Fig 21: Peritoneal nodule detected on staging laparoscopy

5. This is followed by a complete examination of the anterior wall of stomach.

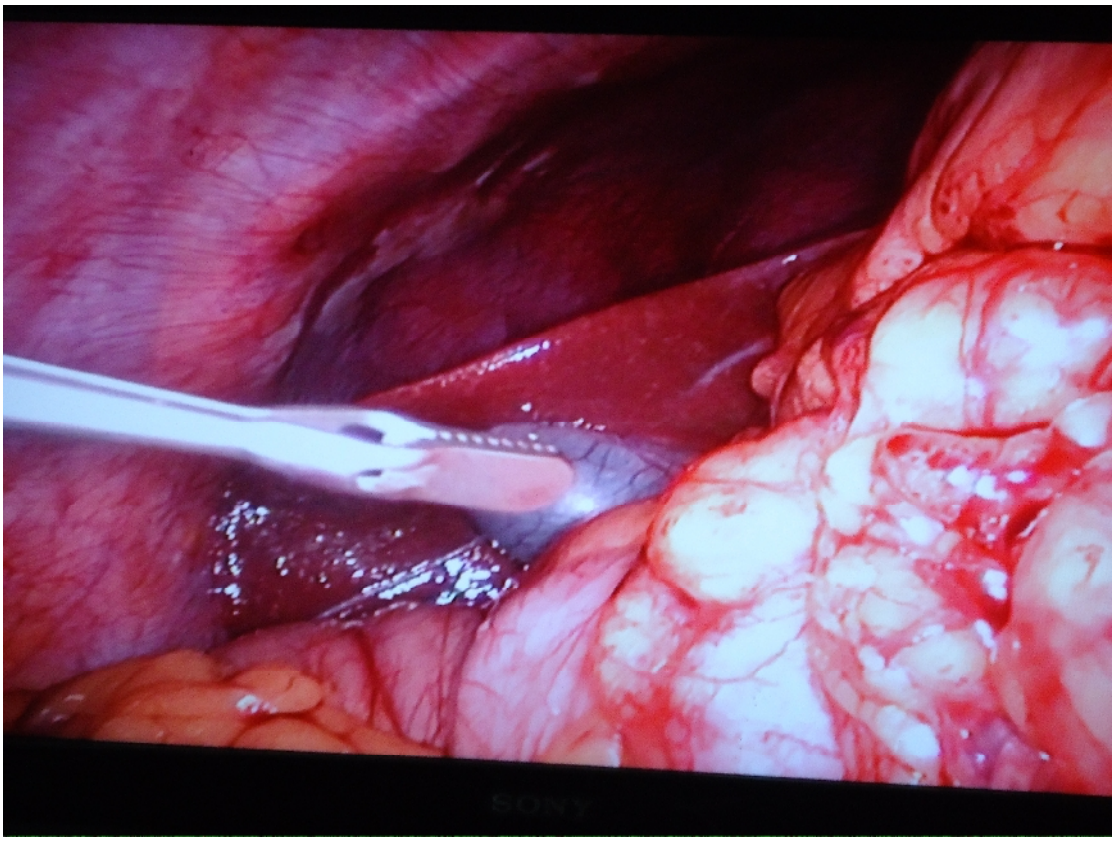


Fig 22: Primory tumour breaching the anterior wall of stomach

6. The gastrohepatic omentum is divided to assess the status of lymph nodes in the subhepatic region and along the lesser curvature. These include the left gastric and celiac nodes.

7. The laparoscope is then introduced into the lesser sac for full inspection

The role of sentinel node biopsy in the preoperative staging of gastric cancer is still under research and extensive studies are required to prove its merits. There is evidence that lymph nodes involved in gastric cancer are increasingly recognized by vital dyes and radionuclides. This further emphasizes the potential role of sentinel node biopsy by staging laparoscopy in carcinoma stomach.

The issue of timing and extent of laparoscopy is unresolved. When performed as a separate procedure it has the disadvantage of the additional risks and expense of a second general anesthetic. However, separate procedure laparoscopy allows the additional staging information acquired at laparoscopy (including the results of peritoneal cytology) to be reviewed and discussed with the patient and multidisciplinary treatment group prior to definitive treatment planning. Consequently, the timing of laparoscopy varies in different centers depending on factors such as the availability of intraoperative cytology assessment and the use of preoperative treatment approaches.

AIMS AND OBJECTIVES

AIMS AND OBJECTIVES

The objectives of the present study are

1. To determine the feasibility of using diagnostic laparoscopy as a preoperative staging procedure in carcinoma stomach

2. To evaluate its superiority as a diagnostic tool in assessing peritoneal and nodal metastasis.

3. To evaluate the role of staging laparoscopy in predicting the accurate stage of disease and hence avoiding unnecessary exploratory laparotomy

4. To assess the morbidity and mortality associated with or without the inclusion of the staging laparoscopy in patients with carcinoma stomach

MATERIALS AND METHODS

MATERIALS AND METHODS

1.	Setting	:	Department of General Surgery, Government Stanley Hospital, Chennai
2.	Study design	:	Non-Randomised Controlled Trial
3.	Ethical Clearance	:	Obtained
4.	Study period	:	1 year
5.	Materials	:	40 patients of Carcinoma stomach (23 male; 17 female)
6.	Inclusion criteria	:	Patients with Carcinoma stomach proven by OGD and Biopsy
7.	Exclusion criteria	:	Patients unfit for any surgical procedure, Pts with proven metastatic disease by imaging

8. Methodology

All patients diagnosed with carcinoma stomach by OGD scopy and biopsy were stage grouped after USG and CECT abdomen and pelvis. They were allocated into two groups of which one was subjected to a Diagnostic Laparoscopy just before the definitive procedure while the other was directly taken up for laparotomy based on imaging alone. The staging laparoscopy included visualization of the primary tumour, regional lymph nodes, liver, diaphragm and peritoneal surfaces and biopsy of abnormal findings. The patients were then staged according to the staging laparoscopy findings. For patients with evidence of metastasis, the definitive procedure was abandoned. If these patients had GOO, a feeding jejunostomy alone was done. For patients without evidence of metastasis, definitive procedure was carried out. For the second group, exploratory laparotomy was done and procedure performed as per findings.

9. Analysis Using SPSS 16.0

RESULTS AND ANALYSIS

RESULTS

Table 4: Gender distribution

Gender	D-lap group (n=20)	Laparotomy group (n=20)	p value
Male	12 (60%)	11 (55%)	1.00
Female	8 (40%)	9 (45%)	

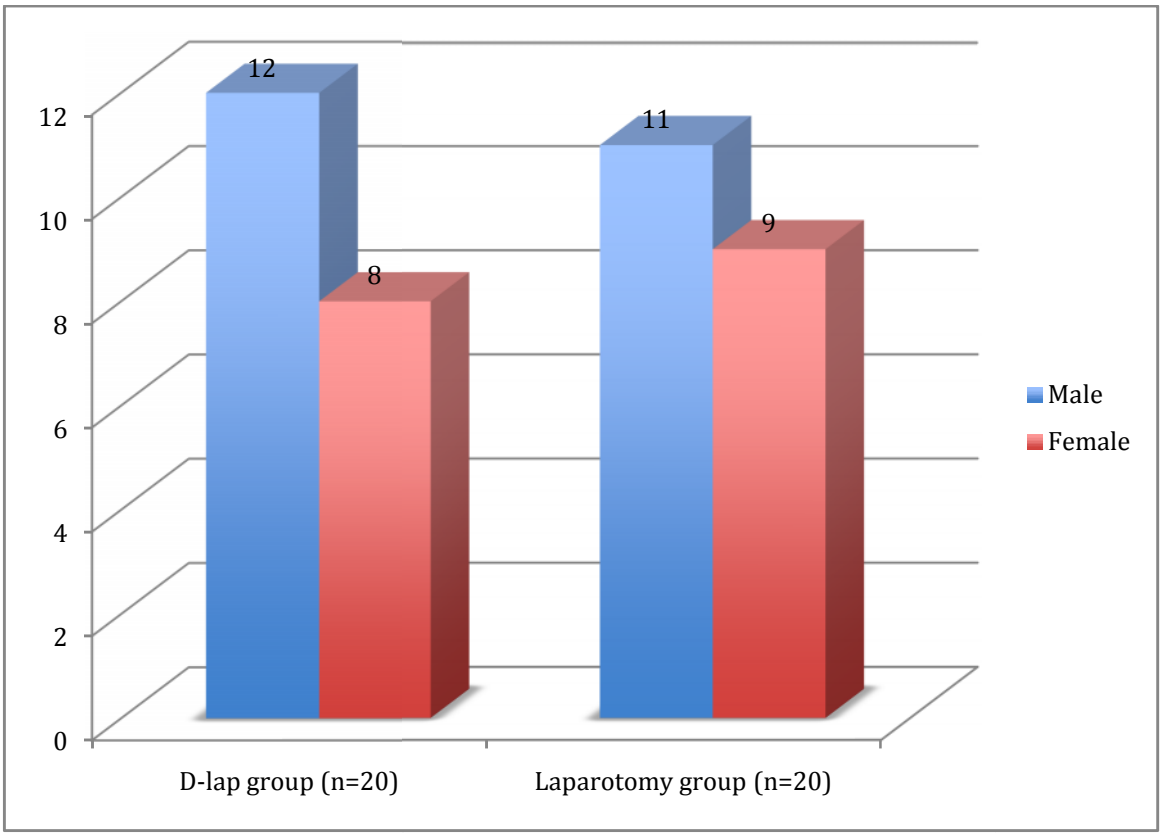


Table 5: Age distribution

Age group	D-lap group (n=20)	Laparotomy group (n=20)	p value
20-40	3 (15%)	4 (20%)	0.39
40-60	11 (55%)	8 (40%)	
>60	6 (30%)	8 (40%)	

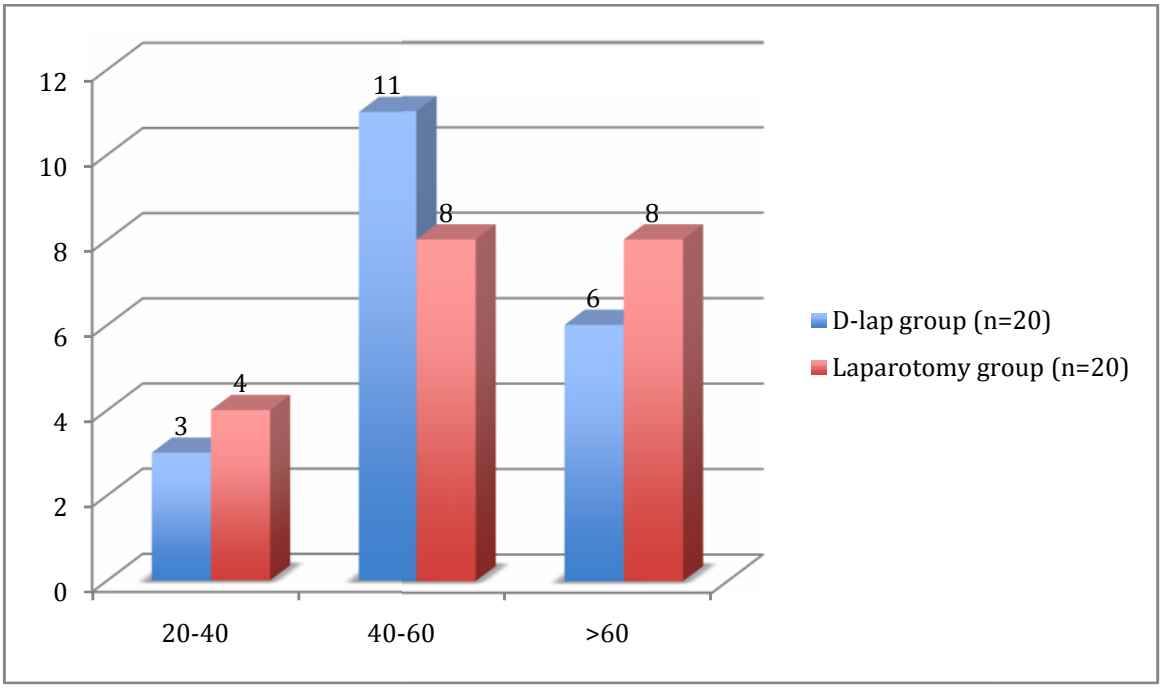


Table 6: Site distribution

	D-lap group (n=20)	Laparotomy group (n=20)
Proximal gastric cancer	8 (40%)	6 (30%)
Distal gastric cancer	12 (60%)	14 (70%)

All the 40 cases were adenocarcinoma

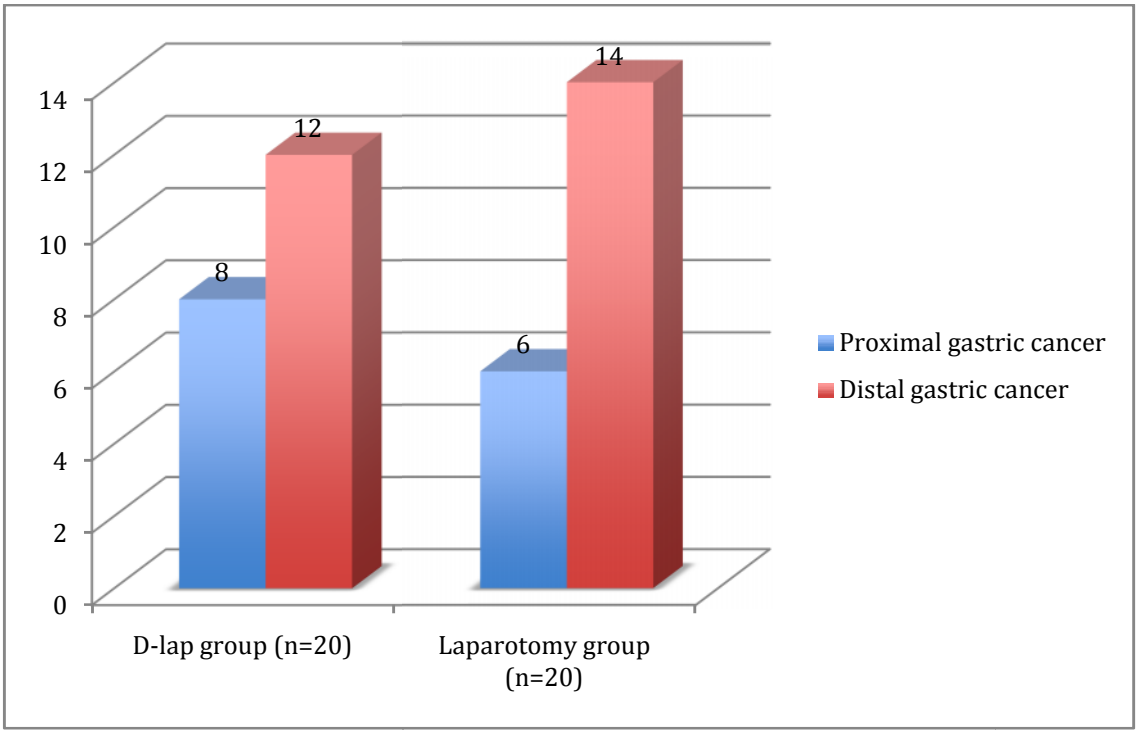


Table 7: Findings of staging laparoscopy and laparotomy

	D-lap group (n=20)	Laparotomy group (n=20)	p value
Mets	4 (20%)	2 (10%)	
No mets - Operable	13 (65%)	13 (65%)	0.66
No mets - Unresectable	3 (15%)	5 (25%)	

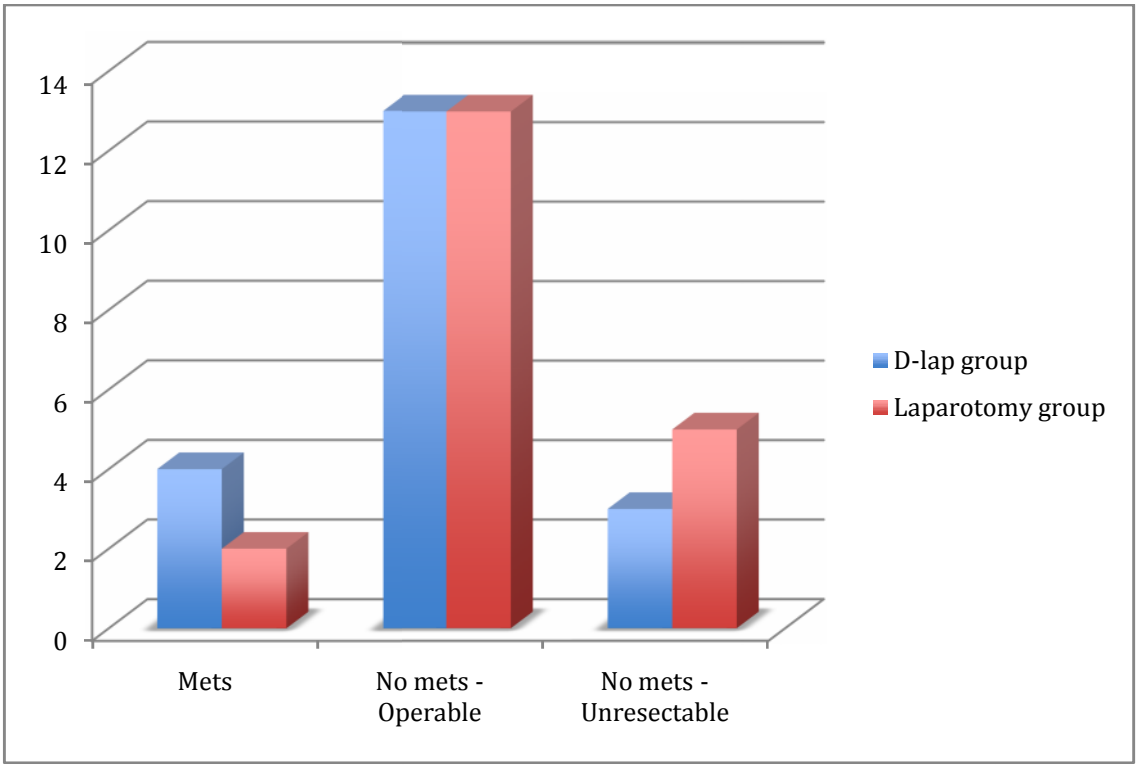


Table 8: Procedure done

	Procedure	D-lap group (n=20)	Laparotomy group (n=20)
Mets group	FJ	2	1
	AGJ	0	1
	None	2	0
No mets group	Total gastrectomy	6	4
	Subtotal gastrectomy	7	9
	FJ	0	1
	AGJ	3	4

Table 9: Morbidity

	D-Lap group	Laparotomy group	p value
Surgical Site Infections	4	4	1.00
Wound dehiscence	1	2	1.00
Anastomotic Leak	1 (conservatively managed)	2 (1 conservatively managed, 1 death)	1.00
DVT	0	0	1.00

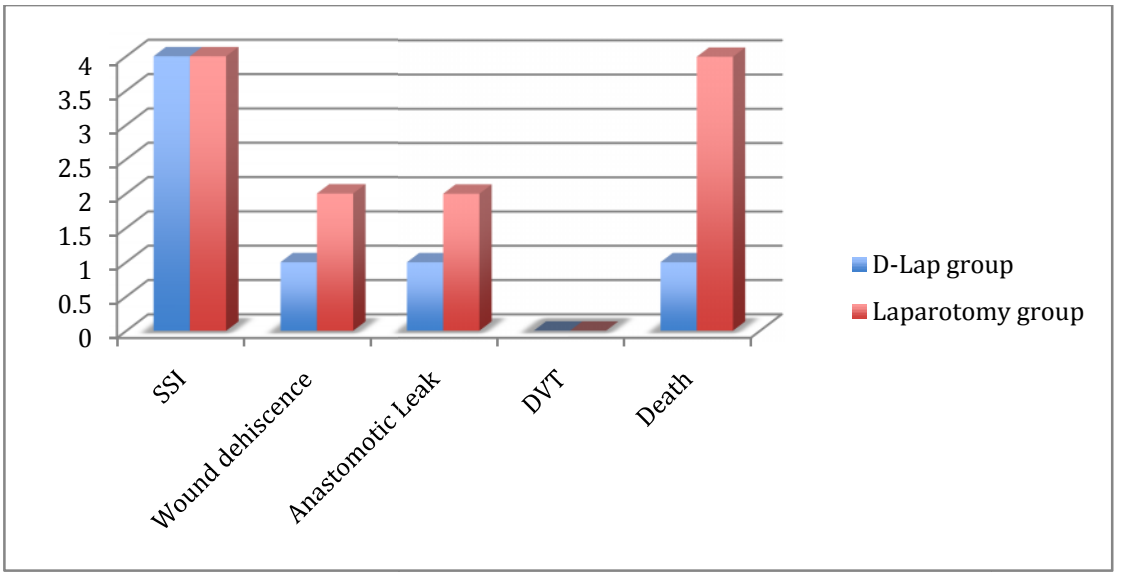
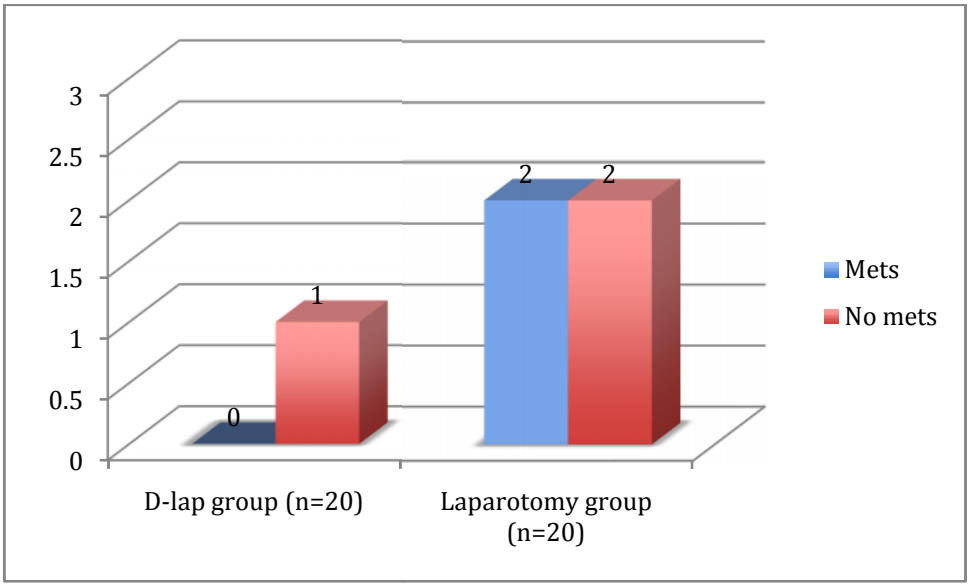


Table 10: Mortality

	D-lap group (n=20)	Laparotomy group (n=20)	p value
Mets	0 (0%)	2 (10%)	0.34
No mets	1 (5%)	2 (10%)	



DISCUSSION

DISCUSSION

A total of 40 patients with Carcinoma stomach diagnosed by Upper GI endoscopy and confirmed by biopsy from the growth were enrolled in the study. They were then staged according to CECT abdomen and pelvis. Patients with evidence of metastasis by imaging were excluded from the study. The rest were allocated into two groups – A Diagnostic laparoscopy (D-Lap) group (12 males and 8 females) and a Laparotomy group (11 males and 9 females) (Table 4).

Most of the patients in both groups, 17 (85%) in D-lap group and 16 (80%) in Laparotomy group, were above 40 years of age (Table 5). However, both age and sex distributions were not statistically significant (0.39 and 1.00 respectively).

On Upper GI endoscopy, 8 out of 20 (40%) in the D-lap group and 6 out of 20 (30%) in the laparotomy group were proximal gastric cancers while the rest were distal gastric cancers (Table 6). The site distribution of gastric cancer was also not statistically significant. All the cases in both the groups proved to be adenocarcinoma on histopathological examination of the biopsy from the growth.

Of the 20 patients who underwent diagnostic laparoscopy, 4 of them (20%) proved to have metastasis and hence definitive procedure was abandoned. Feeding jejunostomy (FJ) alone was done in two of them who had GOO while for the other two (10%) who did not have obstruction, laparotomy was avoided and were directly referred for palliative chemotherapy. Of the remaining 16 patients who did not have evidence of metastasis, 3 had posterior fixity for which Anterior Gastrojejunostomy (AGJ) alone was done and 13 had resectable tumours for which Total gastrectomy (TG) with Roux-en-Y esophago-jejunostomy was done in 6 patients and subtotal gastrectomy (STG) with Roux-en-Y GastroJejunostomy was done in 7 patients.

Of the 20 patients in the laparotomy group, 2 (10%) had evidence of peritoneal / liver metastasis for whom FJ alone was done. Of the rest of the 18 patients who did not have metastatic disease, 5 had unresectable tumours for which AGJ was done in 4 of them and FJ was done one patient. 13 had resectable tumours for which Total gastrectomy was done in 3 patients and Subtotal gastrectomy was done in 10 patients. Although Staging laparoscopy resulted in higher detection of metastasis in patients with carcinoma stomach (20% vs 10%), it was not statistically significant ($p = 0.66$). But this could be explained by the small sample size.

The postoperative complications (table 9) included surgical site infections in 4 patients in each group, Wound dehiscence in one patient in D-lap group and two patients in the laparotomy group all of which were conservatively managed. Anastomotic leak occurred in one patient in D-lap group, which was conservatively managed, and in two patients in the laparotomy group of which one settled conservatively while the other went for sepsis and eventually death. The incidence of immediate postoperative complications was comparable in both groups of patients and the difference it was not statistically significant (p=1.00).

Only one patient (5%) in the D-lap group who had no metastasis but unresectable tumour succumbed eventually in the postoperative period due to cardiac complications. In the laparotomy group, four (20%) patients (two with metastasis and two without metastasis) eventually succumbed. There was no mortality in any of the four patients with metastasis detected by staging laparoscopy whereas both patients with metastasis who underwent laparotomy eventually died. This could be explained by the change in treatment plan according to the accurate staging by laparoscopy in these patients. However, this difference was not statistically significant (p=0.34) again due to the small sample size.

LIMITATIONS

1. The study is done only in a small number of patients.

2. Since all patients had the diagnostic laparoscopy just prior to the definitive surgery, we could not compare the effect of diagnostic laparoscopy when done as a separate procedure.

3. Only direct visualization of the tumour, peritoneal and liver surfaces and diaphragm was done as part of the procedure. Assessment of lymph nodes along celiac axis and left gastric artery by division of gastrohepatic omentum and gastro colic omentum could not be done due to technical constraints.

4. The role of laparoscopic ultrasound and role of tumour markers in predicting peritoneal metastases was also not assessed.

CONCLUSION

CONCLUSION

Diagnostic laparoscopy in patients with carcinoma stomach without evidence of metastasis by conventional imaging has resulted in detection of peritoneal metastasis in 20% (4 out of 20) of the cases and hence upstaging of disease and a change in treatment plan in all of them and also avoidance of unnecessary laparotomy in 10% (2 out of 20) cases.

Moreover, the postoperative complications in the D-lap group without metastasis were comparable to and not significantly higher than those in the control group making it a safe procedure. Hence, a routine diagnostic laparoscopy is advocated for all patients of carcinoma stomach without evidence of metastatic disease by conventional imaging modalities.

ABSTRACT

ABSTRACT

BACKGROUND:

Diagnostic laparoscopy has been advocated as a way of improving staging in carcinoma stomach by detecting low volume liver surface and peritoneal metastasis which are usually missed by conventional imaging, thereby protecting the patient from an unnecessary laparotomy.

AIMS AND OBJECTIVES:

The present study was undertaken to ascertain the feasibility of using diagnostic laparoscopy as a routine staging investigation in patients with carcinoma stomach and to evaluate its superiority over conventional imaging modalities in detecting peritoneal and liver surface metastasis and to assess the morbidity and mortality associated with or without its use.

MATERIALS AND METHODS:

The study is a non-randomised controlled trial wherein 40 patients with carcinoma stomach proven by OGD and biopsy with no evidence of metastasis on CECT abdomen and pelvis were allocated into two groups. One group of 20 patients had a diagnostic laparoscopy done just before the definitive procedure while the other group did not.

RESULTS AND DISCUSSION:

Of the 20 patients in the diagnostic laparoscopy group, peritoneal metastasis were detected in 20% (4 out of 20), hence resulting in upstaging of disease and a change in treatment plan in all of them and also avoidance of unnecessary laparotomy in 10% (2 out of 20) cases.

Moreover, the postoperative complications in the D-lap group without metastasis including wound infection, wound dehiscence, anastomotic leak, DVT were comparable to and not significantly higher than those in the control group making it a safe procedure to perform.

CONCLUSION:

Hence, a routine diagnostic laparoscopy is advocated for all patients of carcinoma stomach without evidence of metastatic disease by conventional imaging modalities.

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BIBLIOGRAPHY

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APPENDIX

Proforma

Role of Staging Laparoscopy in Carcinoma stomach

Investigator : **Dr. M. Srinivasan**,
PGY3 – MS (Gen Surg)

Guide : **Prof. Dr. P. Darwin,** Chief, Unit S1

Name : **Age/ Sex:**

I.P. No. :

Address :

Contact no :

D.O.A : **D.O.S** : **D.O.D:**

COMPLAINTS

CLINICAL FINDINGS

PERFORMANCE STATUS

COMORBIDITIES ASA - 1 / 2/ 3 / 4 / 5

LABS

CBC

RFT

LFT

TUMOUR MARKERS: CEA

CA 125

CONFIRMATION:

ENDOSCOPY

SITE

MORPHOLOGY

BIOPSY

USG

CECT

STAGING LAPAROSCOPY DATE:

OPEN SURGERY DATE:

PROCEDURE

HPE REPORT / pTNM

CHEMO/RT

COMPLICATIONS:

Role of Staging Laparoscopy in Carcinoma stomach

Investigator	:	**Dr. M. Srinivasan**, PGY2 – MS (Gen Surg)
Guide	:	**Prof. Dr. P. Darwin,** Chief, Unit S2.

Patient Information Module

You are being invited to be a subject in this study.

Before you participate in this study, I am giving you the following details about this trial, which includes the aims, methodology, intervention, possible side effects, if any and outcomes:

All patients diagnosed with carcinoma stomach by OGD scopy and biopsy will be included in this study. A detailed clinical history will be taken following a standardized proforma. A detailed clinical examination will be made and relevant investigations, including basic and special investigations will be done and stage grouping will be done after USG and CECT abdomen and pelvis. Patients will be allocated into two groups of which one will be subjected to a Diagnostic Laparoscopy which includes direct visualization and biopsy of abnormal findings on the peritoneal and liver surfaces and entry into the lesser sac by dividing the gastrohepatic ligament which will allow assessment of lymph nodes adjacent to the lesser curve and celiac axis (lymph node stations 16–20). The patients will then be staged according to the staging laparoscopy findings. A pathological staging will also be obtained after the definitive procedure and histopathological examination of the specimen. Tumor markers CEA, CA 125 will also be done for patients in the staging laparoscopy group to look for their correlation with metastatic disease.

The results arising from this study will be analyzed and used for academic purposes. You will be given clear instructions at every step and you are free to ask/ clarify any doubts. Your identity will remain confidential. You are free to withdraw from this trial at any point of time, without any prior notice &/ or without any medical or legal implications.

I request you to volunteer for this study.

Thanking You,

Investigator's Sign
(Dr. M. Srinivasan)

Patient's Sign
(Name:

Role of Staging Laparoscopy in Carcinoma stomach

Investigator : **Dr. M. Srinivasan**, PGY2 – MS (Gen Surg)

Guide : **Prof. Dr. P. Darwin,** Chief, Unit S2.

Informed Consent

Name: Age/ Sex: IP:

I herewith declare that I have been explained in a language fully understood by me regarding the purpose of this study, methodology, proposed intervention, plausible side effects, if any and sequelae.

I have been given an opportunity to discuss my doubts and I have received the appropriate explanation.

I understand that my participation in this study is completely voluntary and that I am free to withdraw from this study at anytime without any prior notice &/ or without having my medical or legal rights affected.

I permit the author and the research team full access to all my records at any point, even if I have withdrawn from the study. However my identity will not be revealed to any third party or publication.

I herewith permit the author and the research team to use the results and conclusions arising from this study for any academic purpose, including but not limited to dissertation/ thesis or publication or presentation in any level.

Therefore, in my full conscience, I give consent to be included in the study and to undergo any investigation or any intervention therein.

Patient's Sign

Investigator's Sign

(Dr. M. Srinivasan)

CASES - STAGING / DIAGNOSTIC LAPAROSCOPY GROUP									
S.NO.	**NAME**	**AGE**	**SEX**	**OGD**	**BIOPSY**	**D-LAP FINDINGS**	**SURGERY**	**POSTOP COMP**	**MORTALITY**
1	SARANGAN	24	M	PROXIMAL	ADENO	NO METS	TG	SSI	
2	MARI	38	M	DISTAL	ADENO	NO METS	STG		
3	MURUGAN	44	M	PROXIMAL	ADENO	NO METS	TG	ANAST LEAK	
4	NAZIR HUSSAIN	45	M	DISTAL	ADENO	**METS**	FJ		
5	PANDIAN	47	M	DISTAL	ADENO	NO METS	STG		
6	RAMAN	55	M	PROXIMAL	ADENO	NO METS	TG		
7	VISHWANATHAN	58	M	DISTAL	ADENO	UNRESECTABLE	AGJ	SSI	
8	MANIKANDAN	52	M	DISTAL	ADENO	UNRESECTABLE	AGJ		
9	DURAIRAJ	62	M	PROXIMAL	ADENO	**METS**	NONE		
10	SANIAPPAN	65	M	DISTAL	ADENO	NO METS	STG	SSI	
11	APPADURAI	60	M	DISTAL	ADENO	NO METS	STG		
12	VALLI	35	F	PROXIMAL	ADENO	**METS**	NONE		
13	VIMALA	53	F	DISTAL	ADENO	UNRESECTABLE	AGJ		
14	SELSA	55	F	PROXIMAL	ADENO	NO METS	TG		DEATH
15	PUSHPA	45	F	DISTAL	ADENO	NO METS	STG		
16	SAROJA	48	F	DISTAL	ADENO	NO METS	STG	SSI	
17	SELVI	28	F	PROXIMAL	ADENO	NO METS	TG	WD	
18	LAKSHMI	63	F	DISTAL	ADENO	NO METS	STG		
19	RANI	65	F	DISTAL	ADENO	**METS**	FJ		
20	CHELLATHAI	68	F	PROXIMAL	ADENO	NO METS	TG		

METS - METASTASIS
TG - TOTAL GASTRECTOMY
STG - SUBTOTAL GASTRECTOMY
FJ - FEEDING JEJUNOSTOMY

AGJ - ANTERIOR GASTROJEJUNOSTOMY
ANAST LEAK - ANASTOMOTIC LEAK
SSI - SURGICAL SITE INFECTION
WD - WOUND DEHISCENCE

CONTROL - LAPAROTOMY GROUP									
S.NO.	**NAME**	**AGE**	**SEX**	**OGD**	**BIOPSY**	**PER OP FINDINGS**	**SURGERY**	**POSTOP COMP**	**MORTALITY**
1	LOGANATHAN	25	M	PROXIMAL	ADENO	NO METS	TG	ANAST LEAK	
2	DHANAPAL	35	M	DISTAL	ADENO	NO METS	STG	SSI	
3	GOUSE BASHA	44	M	DISTAL	ADENO	NO METS	STG		
4	MANAIAH	54	M	DISTAL	ADENO	**METS**	FJ		DEATH
5	ARUMUGAM	56	M	PROXIMAL	ADENO	NO METS	TG	SSI	
6	MOHAN	58	M	DISTAL	ADENO	UNRESECTABLE	AGJ	WD	
7	GANESAN	60	M	DISTAL	ADENO	NO METS	STG		
8	RANGARAJ	72	M	PROXIMAL	ADENO	UNRESECTABLE	FJ		DEATH
9	VARADHAN	68	M	DISTAL	ADENO	UNRESECTABLE	AGJ	SSI	
10	MUNUSAMY	65	M	DISTAL	ADENO	NO METS	STG		
11	GOVINDSAMY	62	M	DISTAL	ADENO	NO METS	STG		
12	PREMA	35	F	DISTAL	ADENO	NO METS	STG	SSI	
13	KALA	38	F	PROXIMAL	ADENO	**METS**	FJ		DEATH
14	JAYALAKSHMI	45	F	DISTAL	ADENO	UNRESECTABLE	AGJ		
15	THULASI	49	F	DISTAL	ADENO	NO METS	STG	WD	

16	SHANTHI	55	F	DISTAL	ADENO	NO METS	STG		
17	PANJALI	58	F	PROXIMAL	ADENO	NO METS	TG	ANAST LEAK	DEATH
18	JANAKI	62	F	DISTAL	ADENO	UNRESECTABLE	AGJ		
19	KANNAMMAL	65	F	DISTAL	ADENO	NO METS	STG		
20	RUKMANI	66	F	PROXIMAL	ADENO	NO METS	TG		